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TWEEDY'S PRACTICAL OBSTETRICS

SIXTH EDITION

BY

BETHEL SOLOMONS

OXFORD MEDICAL PUBLICATIONS

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PRACTICAL OBSTETRICS

OXFORD MEDICAL PUBLICATIONS

TWEEDY'S PRACTICAL OBSTETRICS

EDITED AND LARGELY RE-WRITTEN BY

BETHEL SOLOMONS

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TO

MARGARET

BORN IN THE ROTUNDA

MAY 18TH, 1928

PREFACE TO THE SIXTH EDITION

THIS work embodies the principles and methods of treatment at present practised at the Rotunda Hospital. The first four editions appeared over the names of Dr. Tweedy and Dr. Wrench. In the fifth my name was added. For the present edition I alone am responsible. Although Dr. Tweedy has severed his connection with the work, his influence has been felt throughout.

I have taken up the onus of authorship with the hope that the work may be as acceptable in the future as it has been in the past to the practitioner and the student. Every effort has been made to keep the practical side foremost. While the Rotunda treatment is the main consideration, other opinions are mentioned and discussed.

The number of pages has been increased by 142 and the illustrations by 134. Some of the old figures have been omitted and new ones inserted.

It has been necessary to re-arrange the order of subjects to a slight extent.

Part I deals with the Reproductive Organs and Embryology. The latter is authoritatively treated by Professor Bronté Gatenby, and is a useful addition for those who desire knowledge on this subject. Those who are interested only in the more practical aspects of obstetrics can omit this part without interfering with the sequence of information.

Part II deals with Normal Pregnancy, Labour and the Puerperium, and in this will be found a new short chapter on Antenatal Care.

The first chapter in Part III is on the subject of Toxaemia, and an effort has been made to give an adequate account of the modern theories on this subject; this has been rendered possible by our experience in the antenatal clinic and the vast amount of experimental work which has been accomplished.

Our own views on Eclampsia have not changed and our treatment is still practically the same. There is no doubt

that there will always be some hopeless cases of eclampsia as shown by cerebral haemorrhage in the post-mortem room, but the number of fatal cases should be small.

We have adopted the term Eclampsism for the pre-eclamptic toxaemia. There is a large field for the investigation of Hyperemesis Gravidarum.

We have changed our views with regard to the treatment of Accidental Haemorrhage, and the success obtained in the past two years more than justifies the methods explained in the text.

In Part IV, which concerns Abnormal Labour, it will be found that the chapter on Uterine Inertia has been completely re-written, and a new classification suggested. This difficult complication has been the subject of much thought, and it is hoped that it will now be clearer to the harassed practitioner. I have rarely used the term "contracted pelvis"; "disproportion" is a better term. The diagnosis of Disproportion is dealt with in detail. The treatment is on different lines from those previously adopted, and a trial of labour is one of the important features. Much new matter will be found in this chapter.

The chapter on Obstetrical Operations has been amplified. All operations commonly employed are described and illustrated, special attention being devoted to the Lower Segment Caesarean Section. A short note is appended on Failed Forceps.

Part VII is devoted to "The Infant." In addition to the older systems of feeding, the calorie method is described.

There are several new features in the Appendix. The charts at present in use at the Rotunda are illustrated. Some of the modern tests for Pregnancy are explained, and there is a short exposition of the uses of X-rays in Obstetrics.

I am indebted to many colleagues for assistance in the preparation of this work. Dr. McDonogh, Radiologist, Dr. Bourke, Pathologist, and Dr. Brian Crichton, Pediatrician to the Hospital, have been of great aid in their respective departments. Dr. Ninian Falkiner, my late assistant, was largely responsible for the chapter on Antenatal work, and Dr. O'Donel Browne, one of my present assistants, helped me greatly in the correction of the proofs and in other ways.

Thanks are accorded to Messrs. Baillière, Tindall & Cox

for the loan of blocks from my *Handbook of Gynaecology*, to Messrs. Fannin & Co. of Dublin for the loan of blocks of surgical instruments and equipment, and to my present publishers for the loan of blocks and for their courtesy at all times.

Other acknowledgments are mentioned through the book, and I sincerely hope that I have omitted none that is due. The majority of the new illustrations have been drawn by Dr. Stella Ross, who has worked with unfailing conscientiousness and skill.

In addition my thanks are due to Professor Gatenby, Dr. F. S. Bourke, Miss O'Brien and Dr. E. C. Smith for some of the illustrations.

BETHEL SOLOMONS.

Rotunda Hospital,
Dublin,
December, 1928.

PREFACE TO THE FIFTH EDITION

THE preparation of the Fifth Edition of this work has been complicated by a serious defect in my eyesight, which has made it difficult for me to follow the changes which inevitably occur in the Science and Art of Obstetrics. For this reason I have deemed it advisable to obtain the services of my friend Dr. Bethel Solomons, to collaborate with me in the revision of this edition.

Dr. Solomons' large experiences as a consultant and popularity as a teacher should ensure that nothing of practical importance has been omitted from this edition.

I also have great pleasure in recording here the great help we have received from Dr. R. E. Tottenham, formerly Assistant Master of the Rotunda, who has been assiduous in recording our views, particularly in connection with "Recent Haemorrhages," and bringing to our notice facts of obstetrical importance.

My thanks are also due to our Artist, Mr. J. Morrow, who has admirably expressed our views in pictorial form.

E. HASTINGS TWEEDY.

January 1925.

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PART I

INTRODUCTION

In our last edition we described the pelvis and its diameters at the commencement of the book. We have come to the conclusion that greater benefit will be derived from a fresh knowledge of this subject when studying the mechanism of labour. It is necessary, however, to have some knowledge of the soft parts. In this Part the normal anatomy will be considered, and the changes in pregnancy and labour in their respective chapters.

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CHAPTER I

THE REPRODUCTIVE ORGANS

The Vulva (see Fig. 1). This term is usually used to include the external genitalia, but in its strict sense it is restricted to the parts below the **Mons Veneris** : this is a prominence due to the presence of fat and is situated over the symphysis pubis. The skin in this region is covered in the adult by hair, the arrangement of which is typical of the female, viz. triangular in shape, the base being uppermost. This may be a point of importance in medico-legal cases when the body has decomposed and the sex is in doubt.

Labia Majora. These are two large folds, extending from the mons veneris in front to the anterior margin of the perineum. On the external surface there is a covering of skin and hair, the former containing numerous large sebaceous glands; while on the internal surface there is a lining of mucous membrane, also richly supplied with glands. Posteriorly the labia majora are united by a delicate fold of skin called the **fourchette** ; anterior to this fold, and lying between it and the entrance to the vagina, is a depression known as the **fossa navicularis.** In structure the labia majora correspond closely to the scrotum, since they are composed of skin, superficial fascia, and dartos muscle; the blood supply is abundant; the veins in pregnancy are often dilated.

Labia Minora, or **Nymphae** consist of two smaller folds, and are entirely covered by mucous membrane; anteriorly they unite, but just before doing so they split; the upper portion goes to form the **prepuce of the clitoris,** while the inferior forms the **fraenum** ; posteriorly they are

lost on the inner aspect of the greater labia. The sensory nerve supply is rich, and there are numerous sebaceous glands.

Clitoris. This is a small structure situated anteriorly at the junction of the labia minora. It corresponds to the corpora cavernosa of the penis in the male, and is erectile

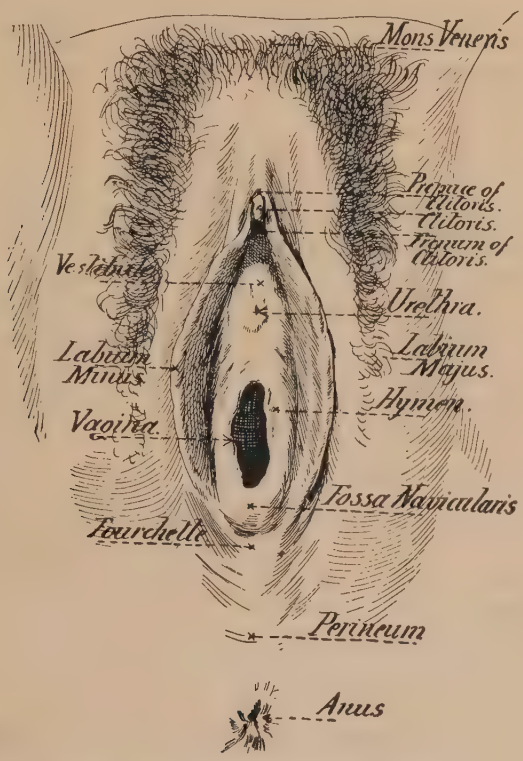

FIG. 1.—The external genitals or vulva.
(From Solomons' *Handbook of Gynaecology.*)

and highly sensitive. The corpora converge from each side, forming the body of the clitoris; they are attached by crura to the ischiopubic rami, while in front there is a suspensory ligament running to the pubis. The glans, or rounded extremity, is covered by a prepuce-like fold, which is continued into a modified fraenum.

Vestibule. A term applied to the area which is bounded in front by the clitoris, laterally by the labia minora, and posteriorly by the anterior margin of the vaginal inlet.

The area is of considerable importance owing to the fact that it contains the site of the orifice of the urethra. The orifice is found to be the first corrugation seen in the mucous membrane, when tracing this area backwards from the clitoris, along the middle line, towards the vagina.

The Hymen. This is a membrane usually somewhat crescentic in shape, which lies inside the labia minora, deep to the vestibule, and which guards the entrance to the vagina. When torn, the fragments that remain are termed carunculae myrtiformes; they exist merely as small projections.

The Glands of Bartholin lie embedded on each side of the vaginal entrance, deep and a little internal to the labia majora, about the junction of the posterior and middle thirds; their ducts open on each side between the labia minora and hymen. These ducts are about half an inch long, and are liable to become infected in the course of an attack of gonorrhoea or other infection.

The Vestibular Bulb is analogous to the structure of the same name in the male; it consists of a mass of veins enclosed in fibrous tissue. Lying a little internal to the labia minora, it takes a backward course on each side from the clitoris.

The Vagina serves as the connecting link between the external organs of generation and the internal, or abdominal organs. Its course is obliquely upwards and backwards, that is to say, if the patient is lying on her back on a bed, the vagina is not parallel to the bed, but makes an angle of about 60° with it; this point emphasises the necessity for propping up the patient when good drainage of the vagina is desired. The vagina is H-shaped on cross-section, its walls are normally in contact, the anterior is about 3 inches in length, and the posterior 4 inches. The walls are lined with squamous epithelium, and the muscular coat is composed of longitudinal fibres. Anteriorly and posteriorly there is a median raphe, from which rugae spread out in transverse directions. Investing the lower end is the constrictor vaginae muscle.

The reaction of the normal vagina is acid, due to the presence of the vagina bacillus; it is probably because of

this acidity that the vagina is distinctly inimical to the growth of parasitic micro-organisms, especially in its upper portion; in the region of the external os their presence is due to an excessive alkaline secretion from the cervix, which permits their growth by neutralising the acid in the vagina.

Anteriorly the vagina is in relation to the urethra and the base of the bladder; the lateral fornices are in relation to the ureters; the posterior wall in its lower two-thirds is

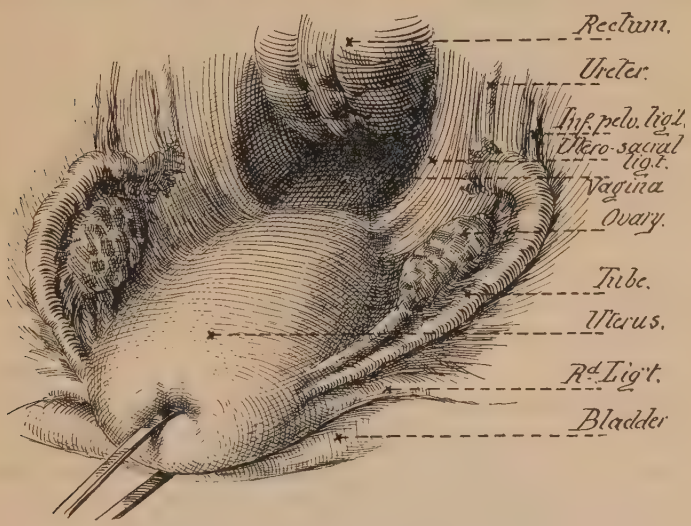

FIG. 2.—General anatomy of the pelvic organs. The uterus is drawn upwards and forwards by a bullet forceps.
(From Solomons' *Handbook of Gynaecology.*)

in contact with the rectum, the upper third being separated from the latter by Douglas' pouch, so that injury to the vagina at parturition may result in injury to the bladder or rectum. The uterus and the vagina arise from those portions of Muller's ducts which fuse early in intrauterine life. Developmental changes cause the uterus to acquire a very thick muscular wall, while that of the vagina is thin.

There are no glands in the vagina, the secretion consisting of transuded fluid, containing desquamated epithelial cells. Foetal remnants may persist in the walls, giving rise in later life to vaginal cysts—the cysts of Gaertner's ducts.

The Uterus (see Fig. 2). The uterus is a hollow, muscular organ, somewhat pear-shaped, weighing from 1 to $1\frac{1}{2}$ ounces, and is about the size of a closed fist. Its wall is about $\frac{3}{4}$ inch thick. It is divided into three parts: (1) an upper or fundal part, above the entrance of the Fallopian tubes; (2) a middle part or body, between the entrance of the Fallopian tubes and the internal os; and (3) a lower part, or cervix, extending from the internal os and projecting through the vault of the vagina. The normal position of the uterus is one of anteversion and slight anteflexion, so that when a woman is standing erect the body lies almost horizontal, the fundus resting on the bladder, near and somewhat behind the symphysis pubis. Physiologically the uterus possesses a varying degree of mobility which depends on the amount of distension of the bladder and other neighbouring organs. So long as the uterus can return to its normal position naturally, any variation of the above position may be regarded as physiological. The cavity of the uterus, flattened antero-posteriorly, with the two walls nearly in apposition, is capable of containing a few drops of fluid; it is triangular in shape, the base being at the fundus, the upper angles corresponding to the openings of the Fallopian tubes and the apex to the constriction known as the internal os. The internal os is supplied with a strong sphincter of muscle fibres and closes off the cavity of the body from that of the cervix.

The cavity of the cervix is fusiform in shape, and in the nulliparous woman is as long as that of the body ($1\frac{1}{4}$ inches), *i.e.* the whole length of the uterus is $2\frac{1}{2}$ inches; its breadth is 2 inches. This cavity, as already mentioned, is closed above by the internal os, and below by the muscle, which, with the addition of elastic and fibrous tissue, forms the rounded or slit-like aperture in the centre of the vaginal portion of the cervix, the external os.

It is usual to describe the unstriped uterine muscle as being arranged in layers, but recent investigations have proved that while it is possible to demonstrate this in pregnancy, it is difficult to show it in the non-pregnant organ. Intermingled with the unstriped muscle is a vast amount of fibrillar connective tissue, containing in its meshes a large

number of oval or spindle cells; it is probably a form of embryonic connective tissue. The muscle fibres surround the intrinsic blood vessels in a figure-of-eight manner and thus exercise a powerful constricting force on them. The

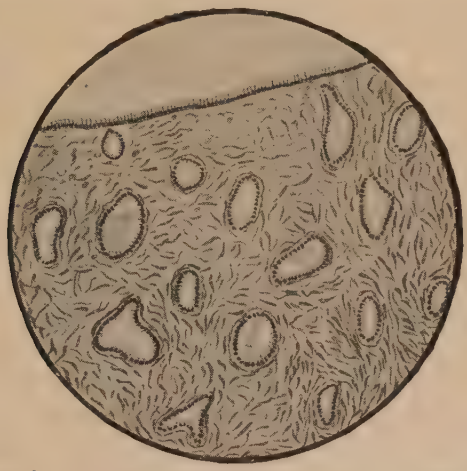

Fig. 3.—Uterine mucous membrane: interval stage. (From Solomons' *Handbook of Gynaecology.*)

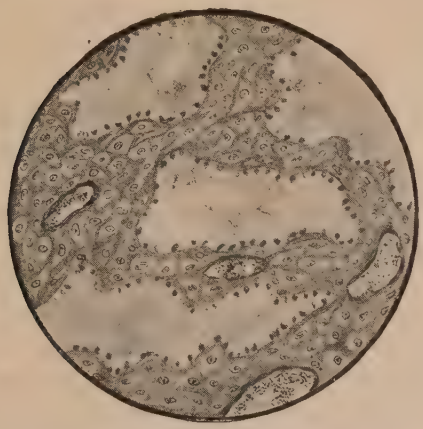

Fig. 4.—The mucous membrane of the uterus in pregnancy. (From Solomons' *Handbook of Gynaecology.*)

proportion of muscle to connective tissue is greater in the body than in the cervix. Some of the muscle fibres enter into the round, ovarian and utero-sacral ligaments.

The cervix in the non-pregnant condition is divided into two—the supravaginal and the vaginal portions. The main

importance in the differentiation is that the bladder is in relation to the former portion only.

The **mucous membrane** of the uterus is smooth, and is known as the endometrium (Figs. 3 and 4), and the mouths of the uterine glands open into the cavity. There is no intervening submucous layer. This insertion makes for irregularity, and it is believed that it is from this irregular dip into the muscle that the mucous membrane is regenerated after the operation of curettage.

The endometrium consists of a surface epithelium, glands, and an irregular binding structure—the stroma. The epithelium is of the columnar ciliated variety, but the cells are not so tall nor so slender as those of the cervix. The glands are of the simple or branched tubular variety, and are lined by epithelium continuous with, and similar to, that on the surface. The glands extend down to the muscular coat and sometimes penetrate the muscle, carrying with them some of the stroma.

The **cervical mucous membrane** has a longitudinal ridge anteriorly and posteriorly, from which other ridges branch off laterally, giving the appearance which has been described as the **arbor vitae.** The epithelium is columnar in the cervical canal, while that on the vaginal portion of the cervix is squamous. It will be seen from above that the uterus, like the vagina, is so related to other organs that injury to it may involve the bladder, the rectum, and the important parametrium.

The **Ovary** is found on the posterior aspect of the broad ligament. It is connected with the uterus by the **ovarian ligament,** which contains some smooth muscle fibres continuous with those of the uterus. From the tubal extremity there passes a peritoneal fold—viz. the **infundibulo-pelvic ligament**—which becomes lost in the peritoneum covering the external iliac vessels and the psoas muscles. This ligament contains between its layers the ovarian vessels and nerves as they pass down into the pelvis to reach the ovary. The vessels and nerves entering the ovary are enclosed in a sheath of peritoneum derived from the posterior layer of the broad ligament. In this way the ovary is connected along the whole length of its anterior border

by a very short mesentery, or **mesovarium**, to the posterior aspect of the broad ligament. The tubal extremity of the ovary is connected directly with one of the largest of the fimbriae of the tube, which is called the **fimbria ovarica.**

Part of the surface of the ovary is covered by a layer of cubical epithelium.

The ovary is divided into—(1) a **stroma**, or medulla, consisting of compact fibrous tissue and a few unstriped muscle fibres, which is really the part of the ovary which binds together the important epithelial parts and conveys the blood vessels and lymphatics; and (2) a **parenchyma**, or **cortex**, or **epithelial** portion, which is the chief functioning portion, and whose properties will be discussed.

The chief portion of the parenchyma consists of the Graafian follicles and ova. In it are found spindle-celled connective-tissue cells in various stages of development, some of these being primordial and others being more developed (Graafian follicles).

The Primordial Follicle consists of the primordial ovum (oocyte) surrounded by a single layer of epithelial cells.

The Graafian Follicles are being developed all through the sexual life of the woman.

They have a connective-tissue covering—the theca —which is divided into two : the outer, theca externa, which is like the ovarian stroma, being formed of purely fibrous tissue, in which run the major blood vessels of the Graafian follicle; and the inner, theca interna, which is formed of much larger elements of a non-fibrous nature.

Inside the theca is the membrana granulosa, or epithelial portion, which is formed of small cells several layers thick. The portion which supplies the ovum (oocyte) shows a marked protuberance, and is known as the **discus proligerus**, and that portion which immediately surrounds the egg membrane (zona pellucida) is called the corona radiata. In the inside of the follicle is found the liquor folliculi. The mature follicle is 10 to 12 millimetres in thickness, is fairly superficial in the ovary, and is vascular except at its point of rupture : this point is called the stigma.

Ovulation. This process takes place once a month in

the normal human oestrus cycle. Owing possibly to turgidity of the fluid in the antrum folliculi, and to some change in the membranes, the ripe Graafian follicle bursts, and the ovum flows out with the liquor folliculi and is caught by the fimbriated opening of the tube.

Sometimes, owing possibly to the undue toughness of the ovular membranes and the covering of ovarian tissue, the Graafian follicle fails to burst, and this may mark the beginning of an ovarian cyst, also it may cause irregularity in the oestrus cycle, because without rupture of the follicle a normal corpus luteum cannot form. When the Graafian follicle ruptures, and the ovum and liquor folliculi escape, the formation of the **corpus luteum** begins. There are two main schools of thought as to its mode of origin :

1. That the cells of the membrana granulosa and the theca interna take part.

2. That the membrana granulosa is responsible for the formation of the corpus luteum. This formation of the corpus luteum goes through a definite cycle, and is as follows :

First Stage : Proliferation. The mature Graafian follicle ruptures twelve to fourteen days after menstruation. Only a small portion of the granulosa cells are carried away with the escaping ovum. Those that are left proliferate to at least three times their previous size. When the rupture occurs, the opening caused thereby is closed by blood-clot. Owing to the rapid growth of the granulosa, folds are formed in it. In the process of proliferation, the protoplasm of the cells becomes **luteinised** (filled with fatty granules). These are yellow in colour, and result in the formation of the **corpus luteum** of menstruation. This change takes two or three days. At this time it is a thin-walled structure on the surface of the ovary.

Second Stage : Vascularisation. Vessels are required for the nourishment of this gland, which is now known to be an organ of internal secretion. There is a permeation of the granulosa by fine capillaries from the outer theca and connective-tissue fibres which form a support for the granulosa cells, which become more lutein-like, and therefore more yellow.

Third Stage : Maturity, or Stage of Blossom. In this, the corpus luteum is at its highest secretion point, and gives off secretions into the blood stream. It is probably the only example of a temporary ductless gland in the body. When organisation is complete, the organising tissue forms a protecting dividing membrane between the lutein layer and the lumen contents, and from this layer the cavity of the corpus luteum is gradually filled with a young granulation tissue (as it becomes organised). This protecting band is formed at least six days before rupture. The corpus luteum is still yellow, and is between 1 and 2 centimetres in diameter.

Fourth Stage : Retrogression. When menstruation occurs, the corpus luteum retrogresses. The cells become necrotic, are replaced by connective tissue, and the structure becomes what is known as a **corpus albicans.** This may be of two types :

(*a*) **Corpus fibrosum,** consisting of a narrow corrugated fibrous ring, the centre of which is oedematous granulation tissue containing some blood-pigment.

(*b*) **Corpus candicans,** consisting of a solid scar-like mass. These are not supposed to occur before the age of twenty-eight.

Summary of the Cycle of the Corpus Luteum :

Thirteenth day : Rupture of Graafian follicle with proliferation.

Sixteenth day : Luteinisation.

Nineteenth day : Vascularisation and organisation.

Twenty-fourth day : Maturity, or blossom.

The corpus luteum when fully formed is a yellow body, and varies considerably in size. One of the largest examples has been recorded by the author (B. S.) and Gatenby in a paper published in the *Journal of Obstetrics and Gynaecology of the British Empire* (January 1925), and was about the size of a pigeon's egg. Even although much smaller they function perfectly.

When pregnancy occurs, the corpus luteum survives until about the seventh month ; some say it dies earlier. It has been claimed that a corpus luteum of menstruation can sometimes be diagnosed from that of pregnancy. The latter,

because of its increased blood supply, is supposed to be larger, and it is sometimes found as a small cyst containing clear fluid surrounded by connective-tissue walls and lutein cells. However, work carried out by the author (B. S.) and Gatenby has thrown a doubt on this statement, and it is now generally admitted that there are no safe criteria for distinguishing between the two varieties.

The **ovary,** which is about the size of a damson, can be felt bimanually deep in the lateral fornix, and rather posteriorly. The normal ovary is palpable, and experience enables one to tell when it is enlarged. The normal tube is more difficult to feel; in fact, Baldy has said that when the tube is felt it is abnormal. We believe that with practice it will be felt stretching over the ovary.

Origin of the Ovary. The origin of the ovary has been studied in many mammals, and it has been shown that, contrary to the original view of Waldeyer, all the germ cells are not derived from the germinal (peritoneal or coelomic) epithelium which covers the original genital ridge of the embryo. John Beard first showed that there was a migration of cells up the wall of the yolk sac into the region of the early ovary or testis.

In the new-born child the ovary is said to contain as many as 100,000 oogonia (primitive ova), but a large number of these undergo atresia at the oocyte stage of their development. The reason why so many eggs become atretic has not been explained, but nearly all the peculiar glandular-looking cells found in the ovarian stroma are persistent follicle elements whose oocyte (unripe ovum) has degenerated. These follicle elements flourish for a long time, and probably form the so-called "interstitial tissue" of the ovary.

The Fallopian Tubes.

The Fallopian Tubes are $4\frac{1}{4}$ inches in length. Each consists of four main parts: (1) the infundibulum; (2) the ampulla; (3) the isthmus; (4) the interstitial or uterine part. It extends outwards from the fundus uteri in the upper part of the broad ligament. Each is surrounded by peritoneum except at its inferior surface, where it is in

relation with the mesosalpinx; this is explained by the fact that the tube shares with the other structures in the broad ligament, the peritoneum, which is thrown over them like a blanket. The abdominal ostium is about $\frac{1}{12}$ inch in diameter, and the uterine ostium is about $\frac{1}{25}$ inch. The former is placed at the bottom of a funnel-like expansion called the **infundibulum**, the margins of which consist of a number of irregular processes called the **fimbriae**—in other words, the infundibulum is the fimbriated extremity of the tube. The part of the tube continuous with the infundibulum, and into which the abdominal ostium leads, is called the **ampulla** of the tube. This is the large funnel-shaped portion, and constitutes about two-thirds of the whole tube. The **pars uterinum** is embedded in the uterine wall; it is also called the **interstitial** portion. The part between this and the ampulla is the **isthmus**; it is extremely narrow, and makes up nearly one-third of the organ. The tube has three **coats**—viz. peritoneal, muscular, and mucous—and is lined by columnar ciliated epithelium. The muscular layers are two in number—an outer longidinal and an inner circular layer. Williams has described another layer in the interstitial portion, consisting only of longitudinal fibres between the mucous and the circular layer, and this fact has probably some significance in the difficulties of tubal resection at this point. There is no submucous layer, but the muscle is separated from the epithelium by a thin layer of loose connective tissue. The mucous layer is arranged in folds, and this arrangement, together with the cilia, have in the past given an erroneous idea that glands are present. The practical clinical point to remember is that these factors aid in making the tube a splendid medium for infection of any sort.

The Parovarium or Epoöphoron. Before leaving the subject of the Fallopian tubes and ovaries, this structure must be mentioned. It is vestigial in nature, and is found between the layers of the **mesosalpinx**—*i.e.* the superior part of the broad ligament. It consists of numerous vertical tubules which stretch from the ovary laterally outwards, and are attached to a horizontal tubule running parallel to the Fallopian tube, called **Gartner's duct**; this duct,

progressing inwards, ends in the vagina, while outwards it ends either blindly or in a number of branching tubules, known as **Kobelt's tubules.** **Paroöphoron** is the name applied to those tubules which are found at the uterine end of the broad ligament. Occasionally there may be seen (and we have noticed it especially in sterile women) a pedunculated cyst hanging from the inferior margin of the abdominal end of the tube. This is embryological in origin, and is known as the **hydatid of Morgagni.** Its chief significance lies in the fact that it may attain a size which necessitates removal.

The Ligaments and Paracervical Tissue.

The Broad Ligaments. The peritoneum of the uterus has been described as a mantle thrown over it. On each side the peritoneum covers the tubes and the round ligament. In other words, the broad ligaments are peritoneal folds, which pass off the sides of the uterus, and contain within them the Fallopian or uterine tubes superiorly and the blood vessels of the uterus below. The upper portion of the broad ligament passes from the infundibulum of the tube to the pelvic wall. It is known as the **Infundibulo-pelvic Ligament,** already mentioned.

The broad ligaments also contain the round ligament, some nerves, vestigial structures, and a little fibro-muscular and some fatty tissue; this fibro-muscular fatty tissue is known as the **Parametrium.** These ligaments probably aid in the support of the uterus; this support is largely obtained by the fibrous investments of the vessels, especially those found at the inferior margin around the uterine vessels. It is believed that the fibrous sheaths are a by-product of vascular development.

The Round Ligaments, two in number, are derived from the uterine muscle. They spring from each side of the fundus just in front of the insertion of the Fallopian tubes. Thence they pass to the internal abdominal ring. They traverse the inguinal canal and reach the external abdominal ring, where they emerge and finally terminate in the subcutaneous tissue of the labia majora.

The Utero-sacral Ligaments. These are fibro-

muscular bands, covered with peritoneum, which pass from the posterior aspect of the upper part of the cervix to the bodies of the second and third sacral vertebrae. The muscles which they contain are known as **Retractores uteri.** Inflammation of these ligaments may cause malposition of the uterus, but they do not act as supports.

The Anterior Ligaments, or Pubo-Vesical Ligaments.—These stretch from the anterior part of the cervix to the sides of the bladder and the posterior surface of the pubes. According to some authorities, these ligaments keep the bladder in position. The general opinion held is that they have little supporting value.

Mackenrodt's Ligaments, or the **Lateral Pelvic Ligaments,** or the **Ligamenta Transversalia Colli,** or the **Cardinal Ligaments,** really consist of the inferior part of the broad ligament. They can scarcely be considered ligaments in the literal sense, for each consists of a strong band of fibro-muscular tissue which stretches on either side from the lateral aspects of the upper part of the cervix uteri and from the vault and lateral fornix of the vagina, to form channels for the uterine blood vessels, ureter, lymphatics, and nerves. They stretch from their extremely firm union with the lateral portion of the supravaginal cervix to blend with the connective tissue of the pelvic floor.

From an obstetrical point of view these ligaments are very important, for if forceps are applied before the cervix is fully dilated, or if any forcible dilatation is done, these ligaments will tear, and prolapse of the uterus will result later.

The body of the uterus lies normally in the axis of the pelvic brim, being thus inclined to the vagina at a somewhat obtuse angle. The fundus is rarely found to rise above the brim. The upper three-fourths of the anterior surface is covered by peritoneum, the lower quarter being in contact with the bladder. On its posterior surface the uterus is completely covered by peritoneum. At about the level of the internal os, the peritoneum leaves the uterus and passes backward to the anterior wall of the rectum. The deep pocket lying between the uterus and rectum is called Douglas'

pouch. The pouch is frequently found to be the resting-place of small tumours of pelvic origin, such as ovarian cysts. As the peritoneum leaves the uterus to form the floor of this pouch, it is very close to the posterior vaginal fornix, and an abscess lying in Douglas' pouch can be very readily opened into and drained by this route.

CHAPTER II

GENERAL EMBRYOLOGY

By J. Brontë Gatenby, M.A. (Dubl.), D.Phil. (Oxon), D.Sc. (Lond.), Professor of Zoology and Comparative Anatomy, Dublin University.

Introduction. There are still wide gaps in our knowledge of the early stages in the development of the human ovum. It is true that in recent years some of these gaps have been partially filled, especially those concerned with the early foetus, but much work remains to be carried out on ovulation, polar body formation, segmentation and blastocyst formation. That this is so will appear from the following short account of the early developmental stages, for almost all our views on the human species are formed on analogy with similar epochs in the development of the lower mammals.

The student reading this chapter is advised to make himself familiar with the subject-matter of Chapter I, especially with that dealing with the ovary and corpus luteum.

Polar Body Formation. Before the egg is fertilised the chromosome number is reduced from 48 to 24; as the spermatozoon also brings in 24 chromosomes (hereditary particles) at fertilisation, the original somatic number is restored, so that the embryo will have 24 maternal and 24 paternal chromosomes. The process of polar body formation is not properly known in the human subject. Human oocytes containing polar bodies have been described by A. F. Dixon and Arthur Thomson. In Fig. 5 Dixon's oocyte is shown. It was still in the Graafian follicle, and we are not able to say definitely whether it is to be regarded as a normal specimen. Thomson's material was less well preserved.

The first polar body is a small cell given off from the surface of the egg, containing 24 chromosomes. The other 24 thus left in the egg divide into 48, and 24 of these are extruded as the second polar body, so that the fully matured ovum still has 24 chromosomes.

In Fig. 6 the relationship of polar body formation, (*a*) to reduction of the chromosome number and (*b*) to the production of differences between brothers or sisters is explained. In Fig. 6, A is the ripe oocyte, with the nucleus, N, containing six chromosomes, in homologous pairs, black representing the woman's paternal chromosomes, white the woman's

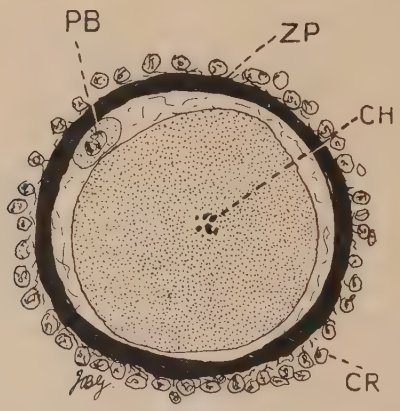

FIG. 5.—Dixon's oocyte with polar body, PB. ZP, zona pellucida; CR, corona radiata; CH, chromosomes.

maternal chromosomes, for it will be remembered that of the 48 chromosomes in the cells of our bodies, 24 are brought in by the paternal parent and 24 by the maternal. In the diagram only six chromosomes are shown. In Fig. 6, B, the polar body (containing rejected chromosomes) has two of the maternal and one paternal. The child which develops from this egg will presumably have strong leanings towards the maternal grandmother. In Fig. 6, C, two maternal chromosomes are rejected, and this child will have leanings towards the maternal grandfather, and so also in Fig. 6, D. The number of possible different hereditary changes which can be produced by 48 chromosomes will be very large. An exactly homologous system occurs in sperm formation.

Fertilisation. It is generally believed that fertilisation

in the human being occurs during the time the egg is passing down the tube, propelled by the movements of the tubal cilia. Probably when the egg reaches the uterus the process of fertilisation has finished, and segmentation is well advanced.

Spermatozoa are able to pass out of the fimbriated opening of the tube into the ovary, where ovarian pregnancy, the result most probably of fertilisation of the egg while still inside the follicle, is occasionally found. In the egg shown

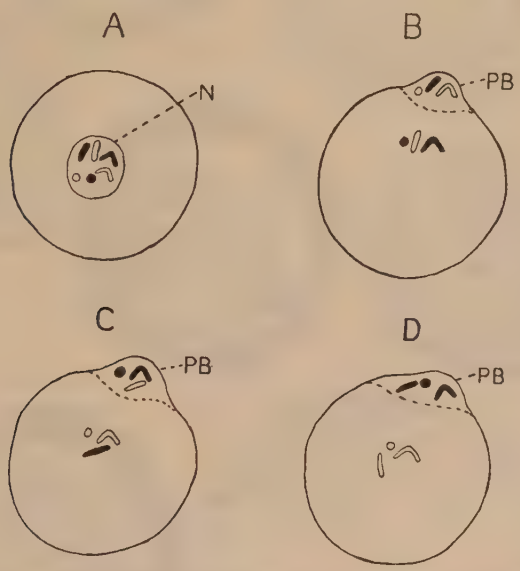

Fig. 6.—Relationship of polar body formation to reduction of chromosomes, and segregation of characters. N, nucleus; PB, polar body.

in Fig. 7 there are a number of unsuccessful sperms (SP) adhering to the zona pellucida, while the successful spermatozoon has penetrated the egg, and is now swelling up to form the male pronucleus (MPN).

Fertilisation is the association of maternal and paternal chromosomes, bearing the hereditary factors, within the same nuclear membrane. Henceforth the ovum develops under the dual influence of the germ plasms of both parents, though, as is well known, the hereditary peculiarities of one parent may dominate over those of the other.

Segmentation. Neither fertilisation nor segmentation

stages are known in the human being. In Fig. 7 are the stages of segmentation and embryonic knob formation in

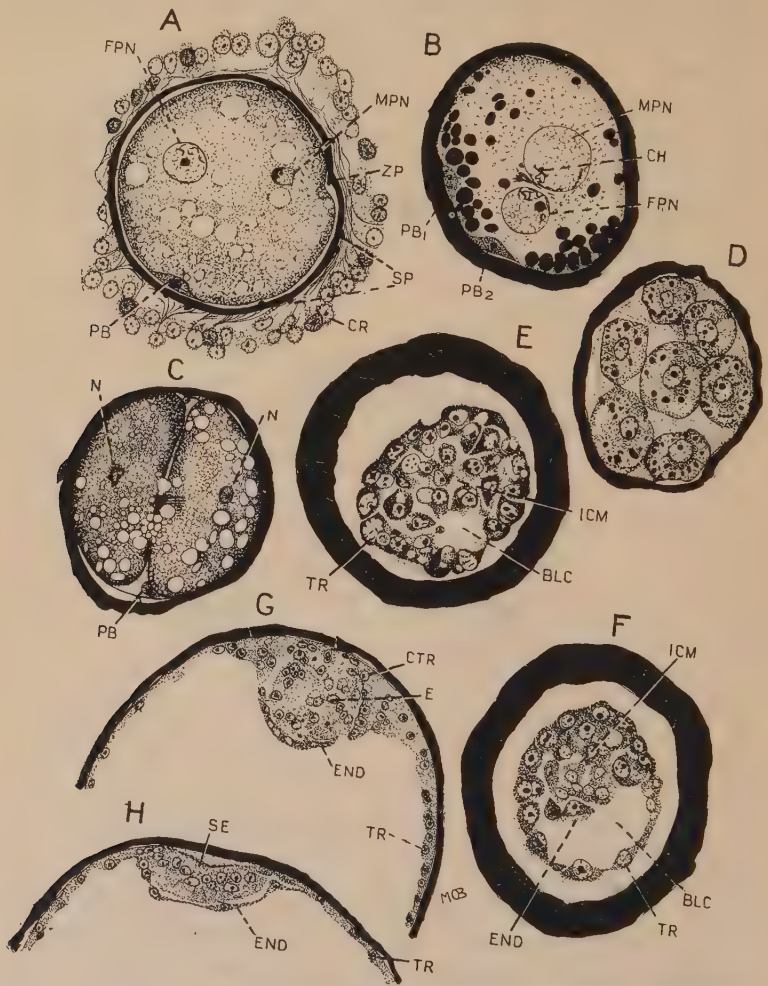

FIG. 7.—Polar body formation, fertilisation and segmentation of the cat's ovum, after J. P. Hill and M. Tribe. BLC, blastocoele; CH, chromosomes; CR, corona radiata; CTR, covering trophoblast, embryo region; END, endoderm; FPN, female pronucleus; ICM, inner cell mass; MPN, male pronucleus; N, nucleus; PB_1, PB_2, first and second polar bodies; SE, shield ectoderm, unsuccessful spermatozoa; ZP, zona pellucida. (By kind permission of Professor E. S. Goodrich, F.R.S.)

the cat, up to the stages when the account may be taken up with human material. Fig. 7, A is the fertilised ovum showing the egg nucleus (female pronucleus) at FPN,

sperm head at MPN, and a polar body at PB. The zona pellucida, ZP, is a gelatinous non-cellular membrane, which is dissolved away before the ovum embeds. At CR is the corona radiata of the Graafian follicle. In Fig. 7, B, the male and female pronuclei are practically fully formed, and contain the minute paternal and maternal chromosomes, CH. The two polar bodies are well seen in this ovum at PB_1 and PB_2. In Fig. 7, C, D and E are stages in the segmentation or formation of the so-called mulberry mass, which hollows out to form a sphere called the blastocyst. By stage E the trophoblast, TR, and inner cell mass (embryonic part), ICM, are differentiated. Subsequently in stages F, G and H, the endoderm (gut cells), END, blastocyst cavity, BLC, the embryonic shield, SE, and embryonic ectoderm (primordium of nervous system and skin) appear. There is as yet no mesoderm (primordium of blood, bone and muscle).

From the scanty knowledge we have of early human ova, it appears that mesoderm is formed very early, and would be found in a stage possibly corresponding to those in the cat given in F and G. The amnion (see p. 25) in the human ovum also seems to be formed quite early, and in a different manner from that of carnivores. It is probable that by the time the human ovum has developed to the stage given in Fig. 7, F and G, it has arrived in the uterus and its passage through the hyperaemic endometrium into the sub-epidermal tissues of the uterus has begun.

Embedding of the ovum. One of the most famous ova, that of Peters (1899), although only two millimetres in diameter, is already embedded. There are now in existence several other ova which are younger than Peters' ovum, *e.g.* the "Miller," "Leopold," "Teacher–Bryce No. 1," and "Von Mollendorff." Many obscure points in our knowledge of the embedding of the ovum have been clarified by the work of J. H. Teacher and Schlagenhaufer and Verocay.

There are no early stages known of the process of implantation in the human being, nor of the history of the ovum from the time it arrives in the uterus until embedding. Grosser has suggested that the ovum reaches the uterus and becomes embedded seven days after fertilisation.

J. H. Teacher considers that the ovum takes three or four days to reach the uterine cavity, and that about the tenth day after fertilisation it attains a stage of development when it must either enter the maternal tissue or perish.

The ovum possibly remains about a week free in the uterine cavity, shielded by some crypt into which it has found its way. During this period it is supposed to be nourished by the secretions of the uterine glands: to the

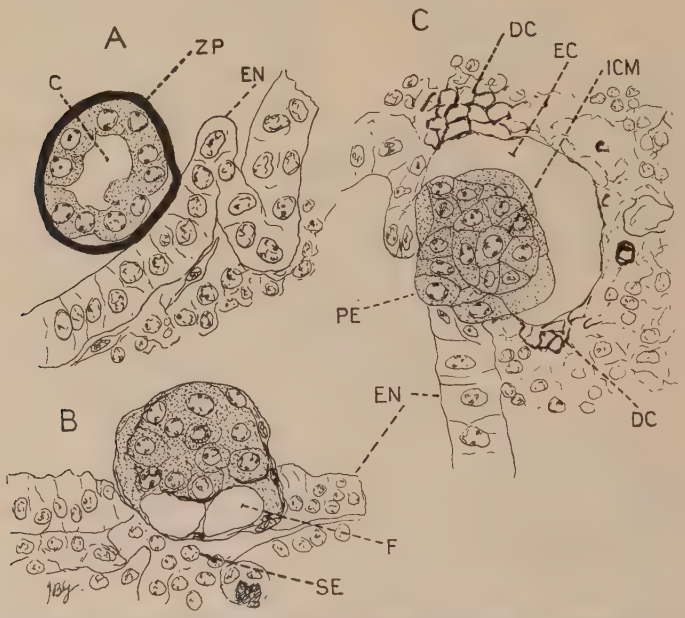

FIG. 8.—Embedding of ovum (Guinea-pig) after von Spee. C, blastocoele; DC, area of necrosed tissue; EC, space eaten out by ovum; EN, endometrium; F, vacuoles in ovum; ICM, inner cell mass; SE, subepithelial tissue; ZP, zona pellucida.

writer it seems just as likely that the intra-cellular lipoids are being drawn upon for this purpose.

It is now generally believed that the human ovum actually corrodes the maternal endometrium, and thus is actively and directly concerned with the process of embedding; the view that the maternal tissue or some kind of coagulum overgrows the ovum is unlikely. Among the lower animals the embedding of the ovum or blastocyst is especially well known in the guinea-pig and the hedgehog, and there are features in the embedding of the ova in these animals which

assist us to understand what probably happens in man. In Fig. 8, A, the guinea-pig ovum, still surrounded by the zona pellucida (ZP), is seen adhering to the uterine epithelium (EN); in Fig. 8, B, the epithelium has been corroded away, and the sub-epithelial tissues brought into contact with the ovum. The latter contains two large vacuoles (F), possibly containing the fluid which has such a corrosive action on the maternal tissue. In Fig. 8, C, the ovum has got in, and has already made a large cavity (EC) for itself; it has also destroyed much of the sub-epidermal tissues, especially at

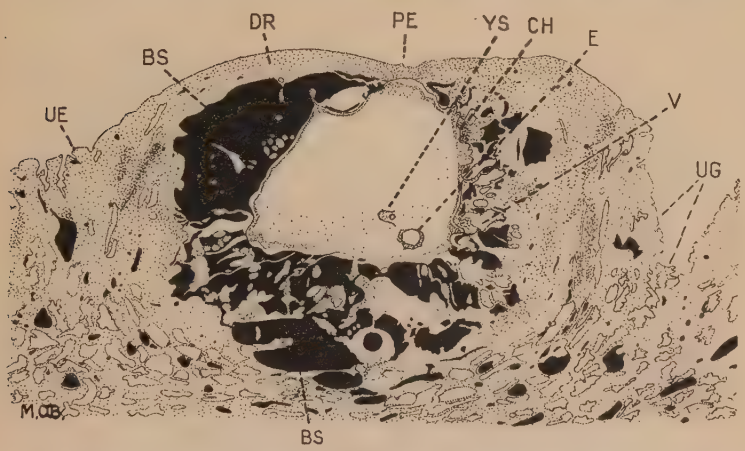

FIG. 9.—Teacher–Bryce ovum No. 2, after Teacher. BS, blood-sinus; DR, decidua reflexa; E, cut embryo; PE, entry point; UE, endometrium; UG, uterine gland; V, chorionic villi; YS, yolk sac.

DC. In man the space marked EC would probably have become filled with extravasated blood. The human ovum shown in Fig. 9 follows on stage C in Fig. 8.

Once the endometrium is corroded the underlying tissue is destroyed in the immediate region of the ovum, provoking inflammatory and reparative reaction (Teacher). Degenerative changes soon appear in the maternal cells, which become hypertrophic and tightly pressed against one another throughout a wide area: they appear like connective tissue elements. This peculiar appearance of the tissue in the immediate area of the ovum is common to all human specimens known; the condition seems to show that the ovum exerts an influence over a remarkably wide area.

Contemporaneously with the embedding of the ovum, the corrosion of the surrounding maternal tissue leads to the formation of a space around the ovum, called the "implanta-

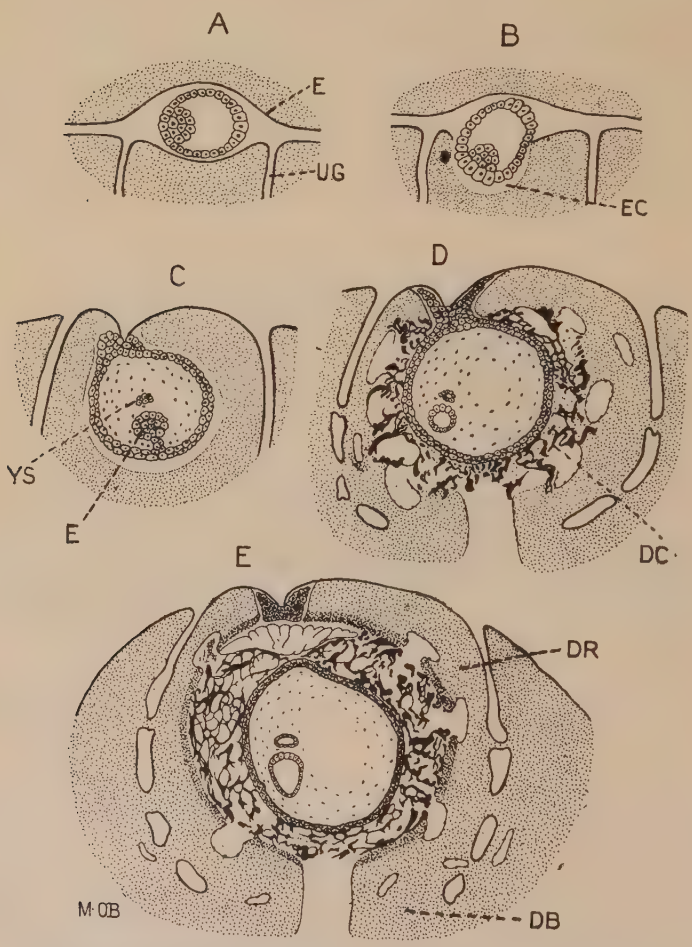

FIG. 10.—Hypothetical embedding of human ovum (after Teacher). (For explanation see text.)

tion cavity," or "pre-villous space" (Fig. 10, EC). With the solution and necrosis of the peri-ovular tissue comes the opening up of a number of blood vessels, which leads to the extravasation of blood into the implantation cavity. For the moment there is possibly no true circulation as such, but

later on it is supposed that active circulation is established before the foetal circulation is perfected.

Recent investigations point to the conclusion that the early human ovum (blastocyst at this stage) has a definite polarity, and that the end towards which the embryonic knob lies (EC in Fig. 10) is instrumental in dissolving away the endometrium. After embedding, that part of the trophoblast nearest the surface proliferates, and, together with some maternal cells and blood clot, forms a plug, so that in the ovum we can recognise also an adhesive or closing pole. This is in accordance with the implantation phenomena in certain other mammals where the blastocyst displays a definite morphological and physiological polarity.

The ovum at this time is lying in a cushion formed of blood and thin strands of cells, and covered by a thin decidua (DR in Fig. 9). It can be understood that congestion caused by mechanical means such as copulation may bring about abortion. This is what happened to the Teacher–Bryce No. 1 ovum; it is known that fertilisation resulted from a single coitus 16½ days before expulsion, and the abortion appears to have been precipitated by coitus about 1½ days before expulsion. Reference to Fig. 9 will explain why abortion even at this early period may be accompanied by marked haemorrhage.

At one time it was thought that the Teacher–Bryce No. 1 ovum was abnormal. Opinion has veered round, and it is now believed that this specimen is normal, and one of the best in existence.

At the time of extrusion from the ovary the human ovum is from ·22 to ·32 of a millimetre in diameter, and J. H. Teacher believes that at the time of embedding, *i.e.* after it has undergone segmentation, it is not much larger.

The Membranes.

The Amnion. This is a thin membrane immediately covering the embryo and containing the liquor amnii. Whatever its phylogenetic origin, the amnion and its fluid serve the purpose of providing a water cushion to protect the foetus from external shocks.

The mode of development of the human amnion is quite

unknown. At the stage H in Fig. 7 of the cat blastocyst, no amnion has yet developed, but some embryologists believe that the human amnion might be formed at such a stage as G in Fig. 7, by a mere hollowing out of the upper layer of cells of the embryonic knob. Alternatively it may be formed by folds as in the rabbit, though this view has fewer

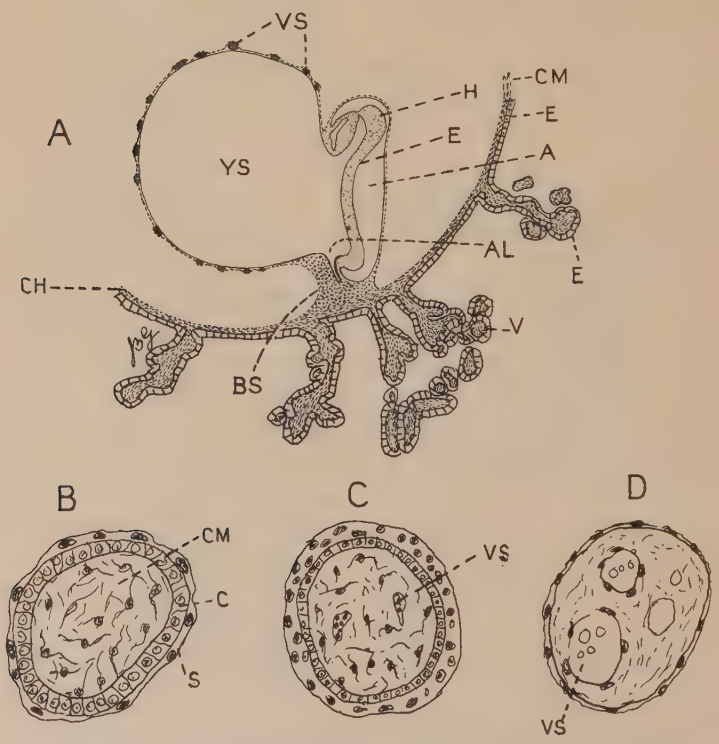

FIG. 11.—Human embryo, chorion and villi. A, amniotic cavity; BS, body stalk; C, cellular trophoblast; CM, mesodermal medulla of villus; E, embryo; H, head; S, syncytial trophoblast; V, villus; VS, blood vessels; YS, yolk sac.

adherents. Until we have further information, either on human or ape and monkey material, it seems useless to speculate.

The position of the amnion in a stage such as that of Von Spee's or Peters' ovum is diagrammatically shown in Fig. 11 at A.

The Chorion. According to the comparative embryologists, the outer extra-embryonic layer of the blastocyst,

composed of a sheet of ectoderm and a sheet of somatopleure, is known as the chorion. In the youngest human blastocyst known, the mesoderm has already spread as a layer beneath the trophoblast wall, and so constituted the chorion. It is the chorion (trophoblast and extra embryonic mesoderm) which comes into contact with the maternal tissues, and forms the embryonic part of the placenta.

The fairly advanced human ova usually seen as aborted specimens are covered with fine processes, giving a fur-like appearance. These processes are known as villi. Each villus contains a core of mesoderm and a covering of trophoblast or ectoderm, and is an outgrowth of the chorion.

There are no known early stages in the formation of the human chorion, but from analogy with other mammals we can understand a good deal about the probable method of its formation.

The wall of the blastocyst (Fig. 7, E, F) is probably single, or at most irregularly double-layered after the differentiation of trophoblast, embryonic knob and yolk sac. Subsequently it becomes organised into two clearly marked layers, known as the cellular (Langhans') and syncytial trophoblasts. Buds and branches from the chorion grow out into the maternal tissue, be it in the uterus or, as in the case of ovarian or tubal pregnancies, into the tubal wall or ovary itself. These villi at first have the appearance depicted in Fig. 11, B, being solid structures consisting of an inner core of mesoderm (CM), a cubical epithelium or cellular trophoblast (C) and an outer layer of syncytium (S). This figure is drawn from month-old foetal villi. Later blood vessels (VS) appear within the villi as in Fig. 11, C, of a villus of the fourth month ; while finally the cellular nature of the villi becomes less apparent, a large part of their cross section being taken up by blood vessels, as shown in Fig. 11, D, nearly full time.

Decidua. The decidua is that part of the mucous membrane of the uterus which has differentiated in a special manner under the stimulus of the ovum. The name refers to the fact that it is stripped off after parturition.

The change of uterine mucosa into decidua probably occurs as a continuation process of the hyperaemia of the

endometrium which is brought about before ovulation. The endometrium swells to a thickness of seven to ten millimetres, and becomes spongy in appearance. The decidua is confined to the body of the uterus, rarely extending below the internal os.

The decidua is divided for convenience into three parts—**decidua vera,** lining the main cavity of the uterus, **decidua basalis** or **serotina,** underlying the ovum, and **decidua capsularis** or **reflexa,** covering or surrounding the ovum. In Fig. 10, the decidua capsularis is at DR, the decidua

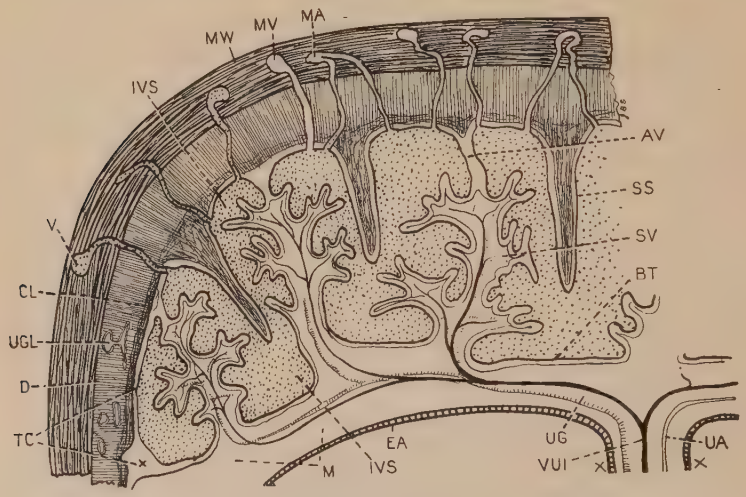

FIG. 12.—The fully formed placenta (after Prof. Arthur Robinson). (For explanation see text.)

basalis at DB. The decidua vera is not shown, as it extends beyond the region of the decidua capsularis drawn. In the Teacher–Bryce No. 2 ovum, in Fig. 9, the capsularis is shown at DR.

The Placenta. The placenta is the very complicated and vascular organ in which an exchange takes place between the mother and the foetus. The latter requires nutriment and oxygen, and the former gives these, and in addition removes waste products deposited in the placenta by the growing foetus. Placentation is a very complicated process, and it is not possible in this short summary to give any but the salient facts. The student interested is advised to read

carefully, in addition to this chapter, the altogether admirable and lucid description of human placentation given in *Cunningham's Anatomy*, by Professor Arthur Robinson, whom we have to thank for permission to use Fig. 12, which is redrawn from his illustration.

The condition of the ovum, at the period when the villi have formed, will have been noted by the reader. These villi, drawn in Figs. 9 and 11, are non-vascular, and their cell elements are at the fullest stage of development. After implantation has been effected, secondary villi begin to form, and the newly-established umbilical arteries of the embryo grow down the body stalk into the mesoderm of the chorion, and penetrate into the villi. A blood circulation in connection with the embryo thus becomes established, and the previous and haphazard manner of connection between the early non-vascular villi and the storehouse of nutriment provided by the maternal tissues becomes organised on a more efficient basis.

In the ovum drawn in Fig. 9 the intervillous spaces had already appeared. These spaces are almost universally admitted to contain maternal blood, and they have been formed in the first place by the corrosion and atrophy of maternal tissue, and the subsequent bursting of the maternal capillaries.

The villi on that side of the ovum which lies towards the uterus, *i.e.* those in the decidua basalis region, increase more quickly than elsewhere, and eventually they constitute the bulk of the ever-growing system of villi, spaces, and blood vessels, which together constitute the placenta.

It has already been mentioned that the mucous membrane of the uterus has swollen up to form the decidua, and the regions of the structure in relation to the embryo have been mentioned. In Fig. 12 we have a schematic diagram of the completed placenta and the uterine walls. At MW is the muscular wall of the uterus, in which are arteries (MA) and veins (MV) which pass into the tissue of the decidua, and form large lacunae, the so-called intervillous spaces (IVS). The decidua at this stage has differentiated considerably, and usually three layers are recognised—the compact layer (CL) lying innermost, and next to the trophoblast of the

chorion (TC), a middle spongy layer with modified uterine glands and an outer unchanged layer (D) lying next to the uterine muscle. At about the fourth month, a histological section across this region shows outermost the muscle, then a region of small spaces, then a region with elongated spaces (the altered uterine glands), and finally the compact layer. It will now be realised that the original uterine glands of the endometrium have increased tremendously and take an important part in placentation.

In Fig. 12 it will be noted that the areas of secondary

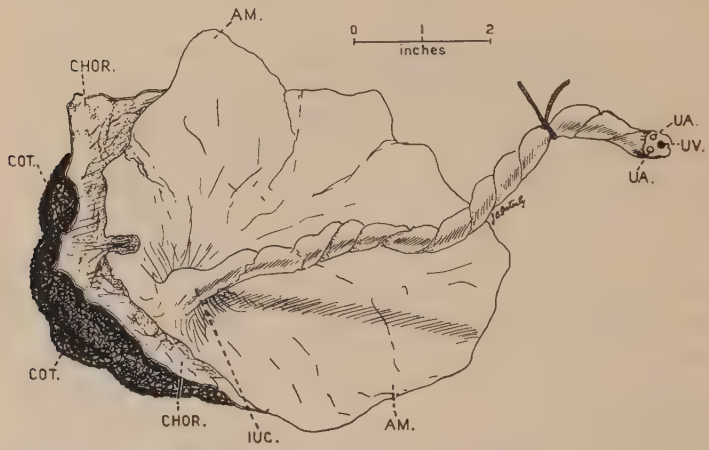

FIG. 13.—The afterbirth. AM, amnion; CHOR, chorion; COT, cotyledon; IUC, insertion of cord into placenta; UA, UV, umbilical arteries and vein.

villi (SV) lie in the intervillous spaces (IVS), which are dotted in, but each system is attached at AV to the compact layer of the decidua. These cell columns, which constitute the region AV, are called anchoring villi, and serve not only to attach the villi systems, but also to strengthen the whole placenta.

In addition, however, large septa from the stratum compactum of the decidua (CL) are found to project down among the foetal villi. The latter have gradually become much longer and more intricate, and their histological character has become changed (Fig. 11). Arthur Robinson classifies the foetal and maternal parts of the completed placenta as follows: (1) the chorion plate closing the inter-

villous spaces internally (TC in Fig. 12); (2) the villi (SV); (3) the intervillous spaces; (4) the basal layer of the trophoblast, which closes the intervillous spaces internally (BT in Fig. 12). These are all foetal.

The maternal parts are (1) the basal layer of the decidua; (2) the remains of the spongy layer; and (3) the unchanged layer.

Detachment of the placenta at birth takes place all around the region UGL, in the spongy layer of the decidua.

The afterbirth is approximately 1 lb. (460 gms.) in weight and is about one-seventh the weight of the child. It has a diameter of 16–20 cm., and is about 3 cm. thick (Fig. 13). The inner surface, to which the umbilical cord is attached, IUC, is glistening owing to the amniotic epithelium, whereas the outer is rough, and divided into areas. This is found to be made up of various portions or cotyledons (COT), which coalesce to form the maternal surface of the placenta. The coarser, more vascular membrane underlying the amnion is the chorion (CHOR).

The Umbilical Cord. The umbilical cord, or funis, is a solid structure which contains two arteries and one vein (Fig. 13), and also, near its connection with the foetus, the allantois and a small part of the coelomic cavity, and which connects the embryo to the placenta. All the nutrimental substances collected by the embryonic parts of the placenta pass with the blood stream into the foetus through the umbilical cord.

The cord is said to be covered by a sheet of amnion, though this has recently been questioned. In Fig. 11 the body stalk (BS) is seen to contain the allantoic diverticulum AL, and it is the elongation of this region which brings about the eventual formation of the umbilical cord. The average length of the fully formed cord is 55 centimetres (22 inches), and the blood vessels it contains are usually twisted from left to right.

The Human Oestrus Cycle.

It is certain that while there may be general similarity in the times of the occurrence of the various events in the inter-menstrual period, exceptions may be met with, and

the following table can only claim to give a general outline. The table is divided up into sections of about five days each, and there seems little doubt that in the majority of women the events tabulated in each section take place within that period.

TABLE OF OESTRUS CYCLE.

		Days.
A	Menstruation; endometrial desquamation, haemorrhage, onset of regeneration.	5
B	Regeneration, proliferation of endometrium.	9
C	Ovulation.	13
D	Migration of ovum to tube (where fertilised), arriving in uterus in three or four days. Corpus luteum develops and begins to cause hyperaemia of endometrium.	17
E	Full development of corpus luteum of ovulation. Ovum now in uterus. Period of expectancy of corpus luteum followed either by onset of atrophy or hypertrophy.	21
F	Embedding of ovum (if fertilised) beginning about ten days after fertilisation. If not, onset of atrophy of corpus luteum.	25
G	Period of onset of pregnancy and further growth of corpus luteum, or cessation of influence of corpus luteum.	1
A	Next menstrual period if ovum does not embed.	5

Beginning with the first period (A), we have menstruation, consisting of the desquamation of the endometrium and the rupture of many of the sub-epithelial capillaries. Subsequently there follow, within this same period, the onset of regeneration and the beginning of proliferation. (For further information about menstruation see text-books of Gynaecology.) The next two periods (B and C) of about eight days cover the complete recovery of the endometrium, and ovulation appears to occur before the latter end of the period C. Most authors are agreed that ovulation in women occurs just before the middle of the inter-menstrual period. The extrusion of the ovum is immediately followed by the rapid formation of the corpus luteum, and this organ may have begun to exert its influence three days after ovulation.

During these three days the ovum has passed into the Fallopian tube, where it is probably fertilised at the distal end, and has been carried into the uterus. During the process, the egg has segmented, and arrives in the uterus as a minute mulberry mass of cells still covered by the zona pellucida. The corpus luteum is forming and is beginning

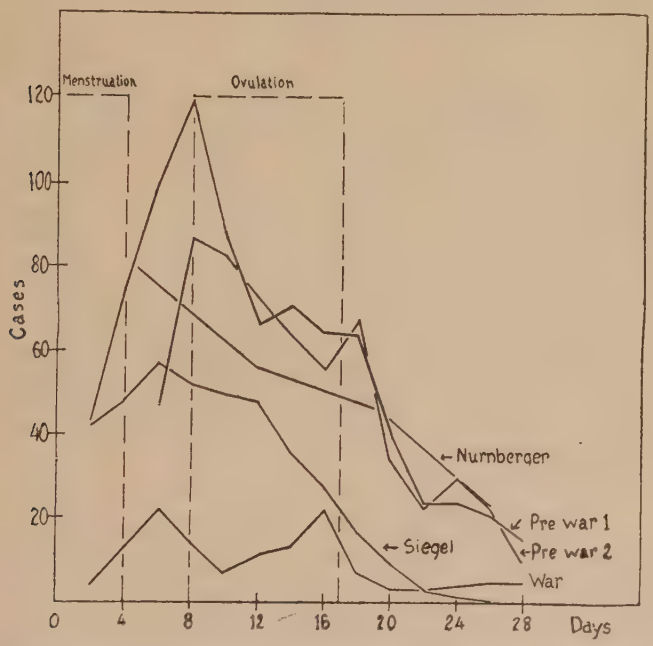

FIG. 14.—Curves of conception: Graph plotted at two-day intervals; point taken at end of the period. Pre-war 1, material from Ahlfeld *et al.*; Pre-war 2, material from Issmer and Fürst; Nurnberger, data given for irregular periods, plotted to centre of period; war data from Jaeger and Pryll; Siegel, average of two curves; percentages, and not number of cases, are represented. (After Asdell.) By permission *Journ. Amer. Med. Assoc.*

to exert its influence on the endometrium. This brings us to the end of period D. The next four or five days bring the following changes. The corpus luteum has arrived at its fullest development as a corpus luteum of ovulation, and may now undergo a period of expectancy of several days. The endometrium is also in a hyperaemic and expectant condition. If the ovum is fertilised and embeds, the corpus luteum grows somewhat larger; if not, it begins to undergo atrophy, the balance overturns, and the events

leading to the next menstrual period are set into movement. On the other hand, if the ovum is fertilised, it begins to embed during this period of expectancy, and the hypertrophy of the corpus luteum puts off the next menstruation until parturition, and the next ovulation heralds the resumption of the cycle.

The life of the unfertilised ovum is probably quite short; there is little likelihood that it lives unfertilised for more than four days, and by glancing at the table, it will be noted that sections F and G could be considered as "safe periods," always supposing that the ovum was shed about the thirteenth day. As, however, there is a good deal of variation in the times of the shedding of the ovum, no reliable basis exists for stating a "safe period." In Fig. 14 is a table prepared by S. A. Asdell from a very large number of observations of his own and of German authors. This table shows that fertility is higher in the early part of the cycle but falls rapidly from the sixteenth to the twentieth day. Asdell agrees that there is little evidence in favour of a period of complete sterility, or of a differential sex ratio at different periods of the month.

The Physiology of Reproduction.

In Ornithorhynchus, where the formation of the corpus luteum is very clear, the theca interna cells have the appearance of actively secreting elements just before and following ovulation. There is therefore some histological evidence for a double secretory activity of the corpus luteum. Nevertheless, the main secretory function of this organ is carried out by the luteal cells.

The corpus luteum has been claimed to control (*a*) the production of uterine hyperaemia, (*b*) the onset of menstruation, (*c*) the development of the mammary glands. The problem has been much complicated by the discovery of Allen and Doisy that the fluid within the Graafian follicle, known as the liquor folliculi, contains an active principle which produces a sexual stimulation, and is able, in ovariotomised (and therefore non-oestrous) animals, to set in motion the changes of the oestrus cycle. According to Parkes, the periodicity of oestrus in such animals as the

mouse is not determined by periodic follicular maturation. We also have the observation of Corner, that in the sow there is always an overlapping in the duration of two generations of corpora lutea. In man there is a clearer-cut arrangement of development and regression of the corpus luteum, but any speculations on the mechanism of oestrus in women should take into consideration these observations on the lower animals.

In any case, however, it appears to be accepted widely that the corpus luteum of the human ovary has the function of inhibiting the succeeding ovulation, and of producing the stimulus for the normal development of the mammary gland. The experiments of Fraenkel make it certain also that the corpus luteum is necessary (*a*) for the successful embedding of the ovum and (*b*) for the continued successful growth of the foetus.

It has been claimed that the active principle of the liquor folliculi is present in the placenta as well as in the ovary. We are not clear, however, whether more than one active principle is involved in the changes which constitute the oestrus cycle of mammals. Years ago Marshall suggested that there might be three hormones involved.

The relationship of such active principle or principles to the proper functioning of the human oestrus cycle is a subject which is only now being investigated, and it is not possible in the state of our knowledge to present any further observations of value.

Sex Determination. In the biological field no theory of sex determination has yet ousted that of the sex chromosome. It is believed on good evidence that so far as sex is concerned, all human eggs are similar, but the spermatozoa are of two types, a slightly smaller male-producing sperm, and a larger-headed female-producing sperm.

Some biologists would not be averse from admitting that some hormonal or nutritional factor might occasionally override the effect of the sex chromosome. The evidence for this, however, is incomplete.

It has been suggested by Schenk (1897) that the sex of the foetus could be influenced by nutritional means, but his views are no longer acceptable.

In 1917, Rumley Dawson suggested that the two ovaries produced different types of eggs, one male-producing, the other female-producing. This theory has been disproved by the fact that women from whom one ovary has been removed can still have children of either sex.

It has also been suggested that the fertilisation time (after ovulation) might have something to do with sex, "staler" eggs producing a different sex from "fresher" ones. This view is not supported either by observations in women or on the lower mammals.

Control of Sex. According to current biologic theory, sex will be controllable when it is possible to separate the two types of spermatozoa without injury to them. Attempts so far made to do this by powerful centrifuges have failed.

On Procuring Human Ova for Study. It is deemed advisable to insert a few words on this important subject at this stage, in the hope that it will encourage the student in the hospital and the dissecting room to be alert for specimens. Nearly all well-known ova have been procured either from (*a*) post-mortem material, (*b*) scraping of the uterus procured during curetting, etc., and (*c*) abortions, "natural" or mechanically produced.

In (*a*) the ovaries of females of child-bearing age should be cut across and examined for corpora lutea. If one is found, the uterus should be excised *without pressure or rough treatment.* In most cases very favourable fixation of material, suspected of containing ova, may be produced by placing the objects in a large bulk of fluid consisting of four parts of commercial formalin to one hundred parts of tap-water. In this the material must lie for four days; then it should be transferred to 50 per cent. alcohol overnight, and upgraded slowly (several days) into absolute alcohol. After careful dehydration the material should be cleared in cedar-wood oil, if it is to be embedded in wax. For further details any text-book of Microtomy should be consulted. It cannot be reiterated too often that the earlier the fixation is carried out the better the results, and rough treatment of the objects will produce artefacts in the position of the various parts afterwards to be studied.

PART II

CHAPTER III

PREGNANCY : ITS PHYSIOLOGY

In considering this subject we must divide the physiological changes into general and local.

General.

The normal woman is usually in better health and increases in weight during pregnancy. This increase is apparent until about a week before labour, when a loss occurs. Her general outlook on life is better, her appetite is good, she is more sleepy and sleeps better, and unless she is unfortunate and suffers from the minor ailments, she will tell her doctor that " she never felt better in her life."

Various experiments have been made with regard to **Protein Metabolism.** The mother takes in more nitrogen than the foetus requires : investigation has shown a net gain of 210 grammes. This increase of nitrogen is probably for the period of lactation.

There is less nitrogen output in the urine. The percentage of urea nitrogen is decreased, while that of ammonia nitrogen and of amino-acid nitrogen is increased. Creatin may be present.

The change in **carbohydrate metabolism** is a tendency to alimentary glycosuria, but the blood sugar is *not* above the *normal.*

Fat Metabolism. There is a disturbed fat metabolism, as shown by acetonuria, which is formed by decomposition of aceto-acetic and beta-oxybutyric acids.

Circulatory Changes.

The Heart. Nowadays it is believed that the heart undergoes very little change during pregnancy. A slight dilatation of the right heart may be discerned, and some

still hold that there is a certain degree of hypertrophy – this is shown by fluoroscopic examination.

The Blood. Certain normal changes occur in the blood. Its volume is definitely increased. There is some slight anaemia, and a pregnant woman is quite normal with the red blood cells down to 4,000,000. Leucocytosis to a small degree is present. The specific gravity is increased until about the fifth lunar month, after which it returns to normal. Calcium salts are increased, while the amount of fibrin diminishes. The CO_2 combining power of the blood is definitely lessened.

Blood pressure is raised in the later months and varicosities occur, haemorrhoids being the most frequently seen.

Endocrine System. It has become the custom to attribute most things to the ductless glands, and it is now possible to theorise and suggest that the increase in blood pressure in pregnancy is due to the pituitary body, the various pigmentations to the adrenals, the leucocytosis to the spleen and the increased calcium content to the ovaries.

Among other changes, the mucous membrane of the **nose** shows definite hyperaemia. **Nausea** may be due to some congestion or change in position of the intestines. The **bladder** undergoes pressure during the last months, and frequency of micturition results. The patient may suffer from **psychoses**, and pains in the joints are common. There is an excess of acid in the mouth of the pregnant woman, and teeth are apt to decay.

Local Changes in Pregnancy.

The Uterus undergoes enormous changes during pregnancy and increases in weight from 1 oz. in the non-pregnant state to 2 lbs. at term. Hypertrophy begins in the first three weeks, the enlargement being in the lateral direction. The whole body becomes more spherical and sinks slightly in the pelvis, causing *flattening* of the abdomen. In the later months an oval shape is present. The increased weight causes the fundus and body to fall over, increasing the normal amount of anteflexion, and brings the os uteri to lie more posteriorly.

After the uterus has risen into the abdomen at the fourth month it increases in size principally in the vertical direction.

The mucous membrane becomes soft and thickened, the cavity dilates, but to a greater extent at the upper pole than at the lower, so that the uterus under normal conditions at this time is found to be ovoid in shape, the narrow end being downwards, thus corresponding to the shape of the foetus in vertex presentation, *i.e.* the breech requires greater space and occupies the fundus. This is one of the reasons for the frequency of presentation of the vertex. The enlargement of the uterus in the early months is not due to any pressure from inside, and it occurs with equal regularity in the presence of a tubal pregnancy. All the muscle coats hypertrophy, keeping pace with the increase in size of the ovum until the last few weeks, then some further stretching takes place, the walls becoming thinner and more accurately applied to the foetus.

One of the most notable features of the pregnant uterus is the change in consistence in the walls. Instead of being hard and firm as in the non-pregnant state, they become soft, yield readily to pressure, and no doubt in this way help in protecting the foetus from injury. This softening can most readily be felt in the cervix, where it forms a probable early sign of pregnancy. There is a marked increase in vascularity with secretion from the cervical glands: this secretion forms a plug of mucus in the cervical canal, which acts as a protection, and is known as the **operculum.**

The growth of the pregnant uterus is associated with a certain degree of stretching of its peritoneal covering, but it is certain that the latter hypertrophies also, in order to keep pace with the uterus. The layers of the broad ligament during the early months of pregnancy become separated, with the result that at full time the ovaries, Fallopian tubes and round ligaments are closely applied to the uterus.

The Muscles. The fibres undergo great change. The actual length of the fibres is said to be increased from seven to eleven times, and the thickness from three to five times. In addition there is much elastic tissue, while the intrinsic blood and lymph vessels are increased. The arrangement of the fibres in pregnancy has always been of great interest.

There are three layers—an external layer consisting chiefly of longitudinal fibres which pass over the fundus to the various ligaments, an intermediate layer which shows a curious figure-of-eight arrangement of the muscle fibres, and which is pierced by the blood vessels, and an internal layer mainly of circular fibres which acts in a sphincter-like manner around the internal os and the Fallopian tubes.

The middle layer is the most important of these, for when contractions occur in the third stage of labour, these fibres act as definite constrictors of the vessels, and prevent haemorrhage. Some observers consider that the formation of the lower uterine segment is commenced in pregnancy. We believe that preparations for its formation are made, for otherwise placenta praevia would scarcely be so common as a prenatal condition, and the stretching of the lower segment with consequent fixing of the head three weeks before labour starts in the primigravida would be unlikely to occur. This subject will be referred to later.

The Tubes and Ovaries. The position of the tubes and ovaries is slightly changed in pregnancy. The fundus rises above the tubes so that the latter appear to be inserted quite low in the uterus. They are longer than in the non-pregnant state, are very vascular, and bleed easily. Instead, too, of being at right angles to the uterus, they lie almost parallel to one another and incline approximately to the uterus. The ovaries appear larger, and this is due to the persistence of the large corpus luteum of pregnancy.

The Vagina. The smooth muscle fibres of the vagina hypertrophy, the blue discoloration of the walls being due to the dilatation of the venous plexuses. The thickened mucous membrane is kept moistened by copious secretion, faintly acid in reaction; the vaginal walls are also said to be increased in length. There is some turgidity in the vulvar region, the labia being separated and bluish in colour due to the dilated veins.

During pregnancy the arteries and veins become large and important vessels, the corkscrew shape being greatly exaggerated.

The uterine artery gives off a branch to the cervix; several important branches go to the corpus uteri, especially one at

the level at which the peritoneum gains firm attachment. The veins dilate and form a network, particularly over the placental site, and lie in the substance of the uterine muscle.

The ovarian veins, which are without valves, increase greatly in size; they lie on each side of the broad ligaments, forming large varicose convolutions, and are easily torn by direct violence. Rupture of these veins may lead to severe bleeding between the layers of the broad ligaments; this is sometimes mistaken for concealed accidental haemorrhage.

The lymphatics increase in size and number, especially on the posterior wall of the uterus.

The nerves also hypertrophy, particularly the cervical ganglion, which is $\frac{3}{4}$ inch long and $\frac{1}{2}$ inch wide in the non-pregnant uterus, and in the pregnant is 2 inches long and $1\frac{1}{2}$ inches wide.

CHAPTER IV

PREGNANCY: ITS DIAGNOSIS AND MANAGEMENT

PREGNANCY may be described as the time when a woman contains within her the products of conception.

Importance of Accurate Diagnosis. The importance of an accurate diagnosis of pregnancy is obvious. Its accuracy will always be proved by the event. The doctor is right or wrong. There is no *via media*, as in the rest of medicine, and a mistaken diagnosis cannot be hidden under the shield of the patient's ignorance. Mistakes are final, and condemnation of them is not to be refuted.

It is on account of this certainty of issue that the signs and symptoms of pregnancy have been divided into those that are certain, and those that are probable. With the certainty of the information conveyed by the foetal signs we agree, but we think that the probable signs have had scarcely sufficient significance attached to them. With experience their united evidence brings a conviction to the mind of the observer, which is practically as positive as the evidence of a sign due directly to the foetus. But the conviction is the private conviction of the observer, based on his own experience, and he may be unduly cautious in committing himself with his patient, owing to his remembrance of the warnings of text-books that the probable signs may play him false. We tell our patient she is pregnant when certain probable signs of pregnancy are well presented, and we do not wait for the certain signs, unless some especial gravity is attached to the diagnosis, as when a patient is unmarried and denies, or is not asked whether she has incurred the risk of fertilisation. Even in such a case, if it is important that a diagnosis should be given before the abdomen becomes prominent, we give the diagnosis when the probable signs are sufficiently evident to convince us.

The definite diagnosis of pregnancy depends on—

1. *The presence of signs due directly to the foetus.* These are the foetal heart, the palpation of foetal limbs, foetal movements, and ballottement.

In addition, an X-ray film which shows the foetal part may now be given as a certain sign of pregnancy (see Fig. 287).

2. *A combination of probable signs.* To elicit these signs, a little experience is required, and their positive value depends on experience. A definite diagnosis of pregnancy cannot be made from symptoms, namely, the things that the patient tells her doctor. But symptoms have their value, for either they arouse suspicion of the possibility of pregnancy, or they agree with the conviction that pregnancy is present.

The Interview with the Patient, including the general management of pregnancy.

Every patient should consult her doctor early in pregnancy. He should then give her advice which should ensure a successful labour. Some women do not seek advice until the later months: in this case much may be done, though not to the extent that is possible when the patient is seen early. Her name and address should be taken—a very important feature: the labour may be at her home, and it is most annoying when called to the case to find that the woman's address has not been noted. In addition, it is sometimes necessary to render an account.

She should be told not to tell her friends she is pregnant: friends have an unpleasant habit of telling a woman of all the ills that may happen to a parturient woman.

Inform her of the usual course of events: tell her the absence of morning sickness is no cause for anxiety; some women are worried if this phenomenon does not occur.

Advise her to live in happy surroundings. We do not know a great deal of the effect of psychological events in pregnancy, but there is no doubt that a healthy, happy mind is essential to a happy pregnancy.

Hygiene of Pregnancy. As for the hygiene of pregnancy, she should live her ordinary life, but avoiding anything which might cause strain, *e.g.* she should not play golf nor any strenuous game. She should not bathe in the

sea. Nothing should be done to "bump" her about, *e.g.* horse-riding, bicycle riding, and motoring on bad roads should be forbidden. No tight corsets should be worn. Tight corsets press on the abdomen below and the breasts above. Therefore tell her not to wear her corsets at all tight; in fact, advise her to wear a belt as illustrated (see Fig. 15). This belt is very simple and has been found most effective. It is divided into two parts. The larger should be worn from the fifth to the seventh month, and the whole belt from the seventh to the ninth month. It is

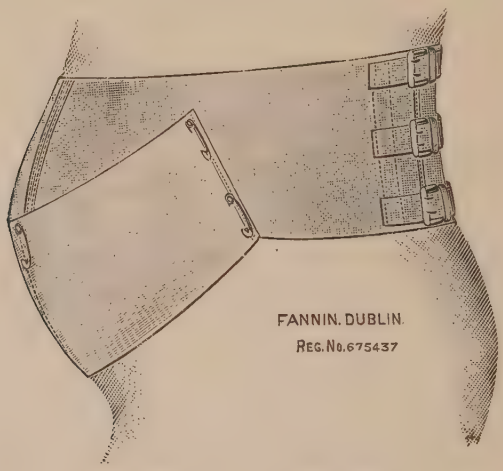

Fig. 15.—Solomons' pregnancy belt.

best worn without corsets, but may be worn with them: suspenders can be attached to the lower part of the belt. Fresh air and walking are beneficial. Fresh air in the house and out of doors is a necessity.

"What is she to eat?" she will ask. Answer her that she can eat anything she can digest, but only at meal-times. Do not let her destroy her natural appetite by drinking milk between meals. She must not eat too much, for pregnant women are apt to eat too much "to keep their strength up." If she becomes peevish as regards her appetite, order her plain, wholesome food and have done with her caprice. Alcohol can never be called a necessity for pregnant or non-pregnant women.

She will do well to take a daily tepid bath: very hot baths may induce abortion.

Toxaemia is the commonest cause of pregnancy troubles. To avoid the collection of toxin in her system, tell her to drink at least two pints of water a day: she should drink a large tumbler of water on rising and at bed-time. Above all, tell her to keep her bowels open once a day. Senna, a vegetable laxative pill, cascara sagrada, Apenta water in the morning, or the hospital sulphate of iron and magnesium sulphate mixture are all good laxatives.

She should be encouraged to believe that pregnancy is a physiological process, and that there is nothing to fear in the labour. It should be explained that the actual confinement will be made as easy as possible, that chloroform will be given. At a later interval it is our custom to describe labour: there is no need to make a mystery about it. We tell our patients that in the first stage "the mouth of the womb" is opening, and that while she may think she is making but little progress, every pain helps.

We ask her to come once a month in the first seven months, and twice monthly after this. We believe that it is wise for a doctor to charge a composite fee for attendance: in this way a woman will get antenatal care. The urine should be tested at each visit, and the blood pressure should be estimated at intervals. There is no need to catheterise the bladder. Instructions should be given that the patient should void urine after a bath, into a scoured vessel, after which it should be poured into a boiled bottle, and brought or sent for examination.

If albumin is found, she should be catheterised.

She should be told to use a mouth wash daily. Milk of magnesia mixed with equal parts of water counteracts the excessive acid which forms in the mouth in pregnancy, and thus helps to preserve the teeth. The old superstition that a woman loses a tooth with every baby is, of course, entirely wrong.

High-heeled shoes should be avoided. The centre of gravity is changed in pregnancy; a pregnant woman is liable to fall. High heels predispose to this all the more.

The nipples should be carefully attended to. We used to order some hardening agent, but we have found this causes more harm than good. We now recommend some emollient ointment to be put on the nipples every night at bed-time during the last months of pregnancy. If the nipples are depressed, they should be drawn out with clean fingers whenever they are bathed. It is sometimes preferable to press the tissues of the breast away from the nipple; this can be done with an ordinary umbrella ring.

There is no reason for avoidance of sexual intercourse, unless there is a history of previous abortions. No intercourse should be allowed in the last month, for fear of starting labour and of infecting the uterus.

If anything abnormal is noted, such as diminution of the amount of urine, headache, or any of the signs of toxaemia, haemorrhage, or any other unusual sign, the patient should call immediately on her medical adviser.

Symptoms and Signs of Pregnancy.

We shall now discuss the symptoms and signs of pregnancy at different months, and describe the method of ascertaining various points in diagnosis.

AT THE END OF THE FIRST LUNAR MONTH

It is unusual for a patient to consult her doctor as early as this, and it is sometimes difficult to make an accurate diagnosis then, but it is extremely important to know the steps to take under such conditions. She will probably consult her doctor to ascertain whether she is definitely pregnant: if he is certain, he will tell her so, but if there is any doubt in his mind, he should certainly tell her of the doubt, and ask her to return in a month. The symptom that commonly brings her is cessation of menstruation, and she will come a week or fortnight after the expected arrival of the usual monthly period, although, of course, it may occur any time in the menstrual cycle. Conception commonly occurs in the first week after a menstrual period. Taking this date, the patient, when she comes, will have been pregnant for four or five weeks.

What symptoms will she describe? She will say that she has shooting pains in the breast, that she passes her urine more frequently, that lately she has felt a little sick in the morning, and that she is constipated. She may also notice that she is particularly sleepy.

She may, however, especially if she is a multipara, have none of these symptoms, and say only she has missed a period.

What signs will be present? The breasts may be slightly engorged and it may be possible to squeeze a little fluid from them: this is not a certain sign, but is suggestive. The hypogastrium may be a little flatter than normal, due to the sinking of the uterus deeply into the pelvis.

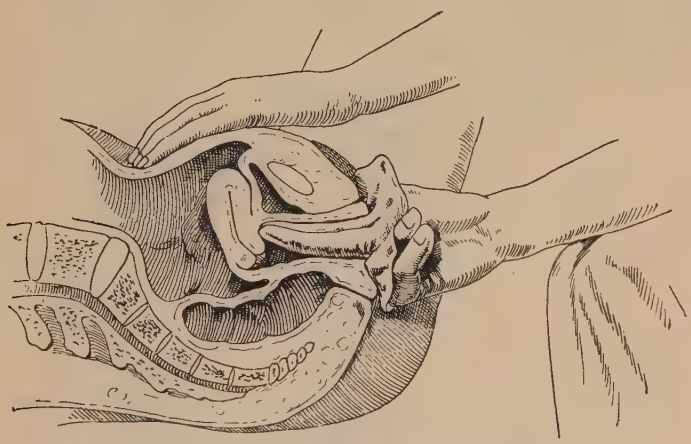

Fig. 16.—Bimanual examination.
(From Solomons' *Handbook of Gynaecology.*)

If any accurate information is to be got by the doctor or given to the patient; if displacement of the uterus is to be excluded, a *vaginal examination* must be made. This applies to the pregnant woman who consults a doctor when the uterus is still in the pelvis: if she consults him later, there is no need to examine by the vagina.

How to make a vaginal or bimanual examination (see Figs. 16 and 17). The best position is that provided by the ordinary gynaecological chair. Failing this, the patient should lie on her back on an ordinary couch with her knees

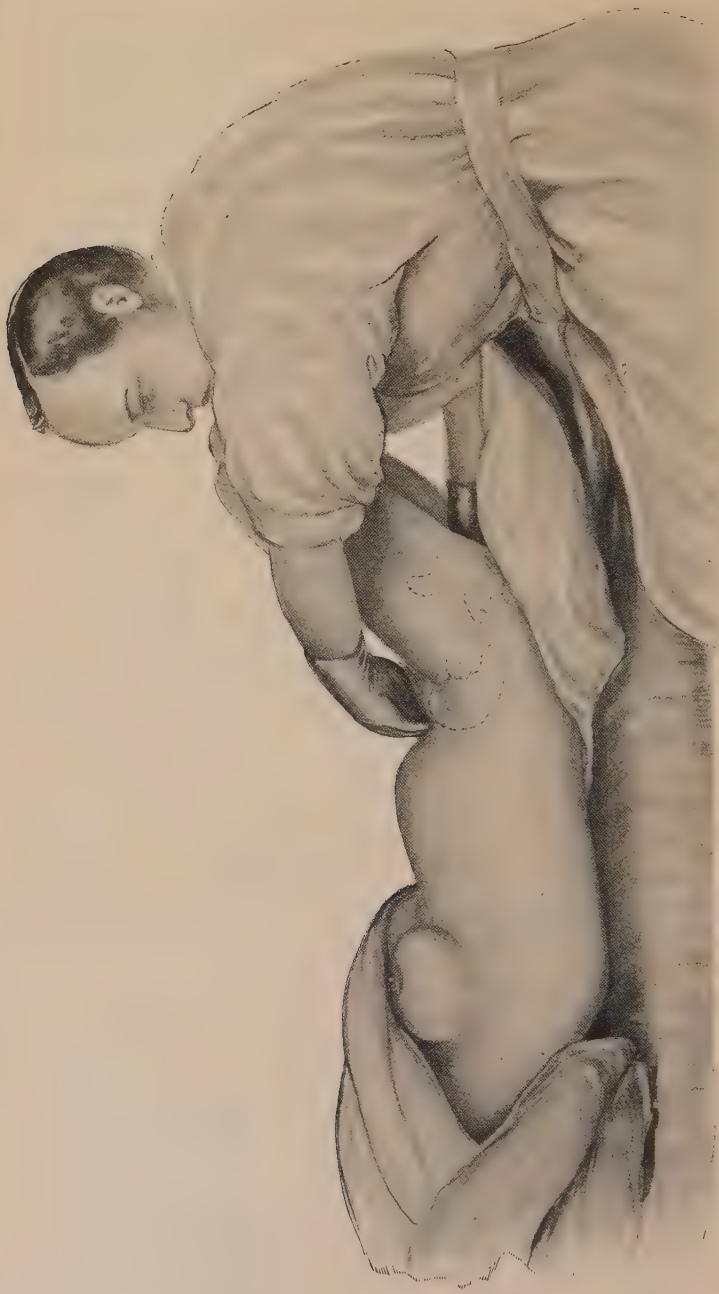

FIG. 17.—Method of making a bimanual examination, when patient is on a couch or in bed.

drawn up. It is a good plan to visit her while she is in bed. Ask her then to lie on her back close to the edge of the bed, to put two pillows under her shoulders, and a bolster under her buttocks, and to draw her knees up a little. She will get into this position herself, while the hands are being washed and immersed in antiseptic. It is a very good position for bimanual examination, for the abdominal muscles are completely relaxed. Having drawn a chair up by the side of the bed, pass the finger in between her thighs, opening the lips of the vulva with the other hand. Prevent her watching the hands, and put heaped bedclothes over her chest and flexed legs. It is useless to attempt to make a bimanual examination with the patient lying on her left side. It is impossible to get the abdominal muscles to relax, nor can the uterus be accurately mapped out.

Before making a vaginal examination cleanse the orifice of the urethra with a pledget of wool soaked in biniodide of mercury (1–1000) and pass a catheter, or better still go out of the room whilst the patient empties her bladder. Invariable attention to this rule will prevent the diagnosis of pregnancy or ovarian cyst when only a full bladder is present.

It is not necessary to douche the vagina before examination. If the patient has profuse leucorrhoea, it may be cleaner to do so. If she has a yellow discharge, make note of its presence, carefully douche her, and treat the cause. We wear a rubber glove, or finger-stall; for the use of rubber gloves, which can be boiled, saves the hands from becoming infected with bacteria and carrying them to other patients.

Having cleansed the hands in the manner described on p. 138, put on the gloves. If the patient be a primigravida, pass the index finger into the vagina first, separating the labia with the fingers of the other hand and noting the colour and moisture of the labial mucous membrane. If she is a multipara, pass in the index and middle fingers.

Sometimes the patient is very constipated, with scybala in the rectum. This makes the vagina tender, and pushes the uterus away from the finger. There is often flatulence as well, which prevents accurate palpation of the uterus. Under these conditions desist from examination, give the

patient a purge, and tell her to come again when the bowel has been emptied.

Signs that are present. There may be a slight blueing of the vulva and of the vagina (Jacquemier's, Spiegelberg's or Chadwick's sign). This blueness is present in varying degrees, from a slight violet to a deep turquoise.

In passing the finger into the vagina, the cervix will be felt rather far back, for the uterus is in a more anteflexed position than normal. Later, when the uterus rises into the abdomen, the cervix rises with it. The cervix is a little soft.

On **bimanual examination** the uterus will be felt more anteposed than usual: it also gives an idea of acute anteflexion: this is caused by the entire weight of the heavy pregnant body of the uterus falling forward. It may feel a little softer and more spherical than normal.

No positive evidence of pregnancy is gained by vaginal examination, but it is learnt that the signs do not contradict the symptoms given by the patient. If, on the other hand, she has made a mistake and the uterus is larger than it should be by her dates, inquire further into the so-called last menstruation.

In addition to these signs, there may be a slight increase in pulsation in the lateral fornices.

What to tell the patient. If a woman has previously borne children her own feelings are of value. In a multipara the symptoms of pregnancy are of more value than in a primigravida, for the former has experienced them before. On the other hand, the signs are not so definite as in a primigravida, for the change from the virgin state to the pregnant is more radical than that due to a repetition of pregnancy.

Tell, then, a multipara that, although it is too early to detect the signs of pregnancy, her suspicions are probably right. Advise her to report once a month until five or six weeks before full term. At this time the abdomen should be carefully palpated and any abnormality of presentation rectified. This is usually easy, and although the abnormal presentation may recur, it does not necessarily do so.

If, on the other hand, the patient is a primigravida and

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there are reasons to doubt the existence of pregnancy, ask her to come again in two months' time. One cannot rely on what she says, nor on amenorrhoea as evidence of pregnancy. Knowledge of medicine and gynaecology reminds one of many conditions, other than pregnancy, which are associated with amenorrhoea. If there is reason to suspect any conditions such as chlorosis, phthisis, haematocolpos, examine for them. Remember, too, menstruation may be delayed or stopped by the nervous effect of the first weeks of marriage, by the desire for a child in a sterile woman, and by many unknown reasons. Lastly, remember a woman may intend to deceive by a false history of menstruation, and may conceal the absence of menses, fearing the dreaded news of her pregnancy. Again, there are other causes of morning nausea and vomiting. For example, they are not uncommon in chlorosis. Therefore, ask the patient to come in two months' time; the probable signs will then be present, and there will no longer be the necessity for depending on her symptoms for diagnosis.

AT THE END OF THE SECOND LUNAR MONTH OF PREGNANCY

Can a positive diagnosis of pregnancy be made at the end of the second lunar month of pregnancy? We think this is possible if Hegar's sign is definitely present, or if Hegar's sign is not so definite, but is associated with the presence of other probable signs. The conviction of pregnancy imparted by these signs is a private conviction. In nearly all cases it is wise to tell the patient, but there are certain cases, where the question of a woman's chastity is entailed, when it is wise to withhold a definite pronouncement of pregnancy until one of the direct foetal signs is present. Even at this early stage of pregnancy there is a very characteristic softening of all pelvic tissues which is noted by the examining finger.

What symptoms does the patient describe? The patient will describe symptoms similar to those at the end of the first lunar month. Nausea, morning sickness, and frequent micturition are more pronounced, and she may have noticed that her breasts are getting larger. Multiparae,

and some primigravidae, however, often do not have morning sickness, nor may swelling of the breasts yet be noticeable.

What to do. If she is a primigravida, examine the breasts covertly, while pretending to listen to the heart, for, if she is unmarried, the patient may not suspect she is pregnant.

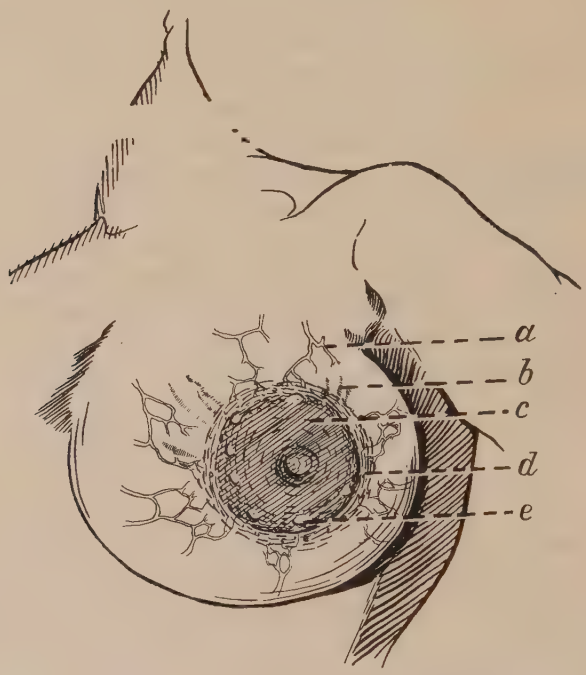

Fig. 18.—Breast changes in pregnancy.

a, enlarged veins; *b*, striae; *c*, primary areola; *d*, secondary areola; *e*, Montgomery's follicles.

Breast changes (see Fig. 18). The breast changes are of positive value in a primigravida, but they have little value in a multipara. The breasts are larger and firmer than they were, the veins more prominent, and the areola round the nipple darkens and spreads. These are all comparative signs and may not be of much value, but the breasts will appear different from those of a virgin. One sign, however, is strong evidence of pregnancy in a primigravida. To obtain it, squeeze the breast gently with the

hand from the base towards the nipple. As a rule, a little clear fluid escapes. This is sometimes found at the end of the second, more often at the end of the third, lunar month. It is a very constant sign in primigravidae, but frequently fluid can be squeezed out of a multipara's breast even when she is not pregnant.

Abdominal sign. Next, if the patient is lying down on the couch, examine her abdomen. The hypogastrium is flat during the first three lunar months of pregnancy, whilst the uterus is a pelvic organ. The sign is not of much value, and if the patient is on the gynaecological couch it is not worth while, after ascertaining the size of the uterus by vaginal examination, to disturb her clothes to look for this sign.

Signs discovered by a bimanual examination. When the thighs are separated, look along the inner surfaces of them, and *venous arborisations*, such as are seen on the beer-drinker's cheeks, will be seen. They are quite good signs of pregnancy according to Barnes, who attached considerable importance to them.

Next open the labia and notice the *colour of the vulva*. It is a faint violet colour, like that of dusky cyanosed lips. Pass the fingers into the vagina, and in doing so separate the orifice a little and it will be noticed that the *vaginal mucous membrane has a faint bluish tinge*, and small varicose veins appear; also that the vaginal mucous membrane is *moist and soft*, and possibly *pulsating vaginal vessels* in the fornices may be felt. The ureters enlarge during pregnancy and can sometimes be detected by palpation. The left is more often palpable than the right. If it should be desired to palpate the ureter, the forefinger is passed into one of the lateral fornices, its palmar surface pointing towards the ceiling; the finger is then flexed slightly, and moved forwards and downwards, towards the anterior vaginal wall. By this manipulation the ureter is hooked up, and can be felt slipping over the top of the finger, as though it were a taut bootlace. A feeling of slight discomfort is experienced by the patient. When demonstrable we consider this a valuable sign.

Next pay attention to the cervix, then to Hegar's sign,

and finally to the size, shape, and consistence of the uterus. We advise this routine method, for unless a routine method is adopted, one of the signs is likely to be overlooked.

The cervix. The cervix, like the vagina, becomes violet in colour. The softness of the cervix is the most definite cervical sign of pregnancy. Distinguish it from the softness due to an erosion by putting in the speculum and looking. An erosion is often present with pregnancy. The distinction between the softness of pregnancy and that of

Fig. 19.—First method of obtaining Hegar's sign.

erosion is not very difficult to make. The erosion gives the feeling of superficial softness over a hard core. But there is no hard core in the softness of pregnancy. The softness of pregnancy begins at the os externum, and in later months is shared by the whole cervix. The cervix feels "boiled through." If this feeling is made out it is very strong evidence. A good rule is, that if the cervix is as soft as the lip, pregnancy is very probable; if the cervix is as hard as the tip of the nose, pregnancy is doubtful. When the cervix is softened by pregnancy the tip of the finger can be pushed into, or can dimple the os externum.

Hegar's sign (see Figs. 19 and 20). In the second, third,

and part of the fourth month of pregnancy the lower third of the uterus is very soft, compared with the soft, yet firmer cervix, and with the main part of the body and fundus of the uterus. This is known as Hegar's sign. This is due probably to the presence in the upper part of the uterus of the whole ovum, while the lower part is empty and thus is easily compressible.

There are three ways of finding out whether Hegar's sign is present or not. (1) Put the finger or fingers in the anterior fornix. With the other hand on the abdomen anteflex the uterus, and press the finger-tips down behind the body of

Fig. 20.—Third method of obtaining Hegar's sign. R, rectum.

the anteflexed uterus to meet the finger in the vagina. If Hegar's sign is present, although the body feels firm and the cervix firm, yet the middle third of the uterus between them is so soft that it feels no thicker than wet blotting-paper. In fact, the *body of the uterus and cervix feel like two independent tumours*, and it will be possible actually to move one independently of the other. (2) The second method: put the finger in the posterior fornix; with the other hand on the abdomen turn the anteflexed uterus straight, and press the finger-tips in just above the pubes to meet the finger in the posterior fornix. This is not quite so good a way as the first, because it is difficult to get the finger to reach high enough up into the posterior fornix above the cervical tissues. (3) The last method is dis-

agreeable to the patient, and therefore is not often adopted. Pass the index finger into the rectum, and the thumb of the same hand to the top of the anterior fornix, and pinch the part of the uterus which is just above the cervix between them.

Size, shape and consistence of uterus. Hegar's sign is found by bimanual examination, so after ascertaining whether it is present or not, proceed to make a careful bimanual examination of the uterus. The uterus at the end of the second month is about the size of an *orange*. It is anteverted in normal cases. It is more spherical and softer than the non-pregnant enlarged uterus. With care it may be possible to distinguish a vertical or oblique ridge in the wall of the uterus, and near the fundus an area of hardness, called the *denser spot*. The *ridge* or groove is supposed by some writers to separate the part of the uterine body which contains the ovum from the part that is only unoccupied decidual cavity. The denser part is supposed to be dense because it corresponds with the part of the uterus that contains the ovum. Whether this be so or not, when these signs are felt they are very good evidence of pregnancy. They are respectively named the "*groove*" and the "*denser spot*."

What to tell the patient. Pregnancy attracts blood to the woman's sexual organs and breasts. Tumours of the uterus, such as fibroids, also attract blood to the pelvic organs, and sometimes reflexly affect the breasts. Blueing of the vulva, vagina, and cervix, increased vaginal secretions and pulsations of vaginal arteries, enlargement of uterus and soft cervix, are consequences of the increased amount of blood. Pregnancy, however, attracts blood more than uterine tumours, so that all these signs are present in a greater degree. It is then a question of comparison, and therefore experience is needed to settle cases in which the signs are not definite. With pregnancy there is amenorrhoea; with fibroids, metrorrhagia is very common. Again, all these signs are rapidly progressive with pregnancy, and an increase in intensity is noticed month by month, which is not noticed with fibroids. Hegar's sign, on the other hand, is associated with pregnancy, and with pregnancy

alone. Bearing these things in mind, if Hegar's sign is present, tell the patient she is pregnant, unless the question of her chastity is involved, when it is wise, in spite of conviction, not to be too dogmatic.

If in a primigravida Hegar's sign is indefinite, as is not infrequent, but there is blueing of the vulva and vagina, soft cervix, and a little clear fluid expressed from the nipple, one will rarely err in diagnosing pregnancy. Enlarged ureters, the denser spot, and vaginal pulsation are useful confirmations, but pregnancy should not be diagnosed unless the other signs are present. In a multipara the symptoms help, and these, with the pelvic signs, will indicate whether she is or is not pregnant.

Sometimes none of the signs is definite. They are all more definite AT THE END OF THE THIRD LUNAR MONTH, and if in doubt it is well to give a guarded opinion and to ask her at the first to return at the end of the third, rather than at the end of the second, lunar month. If the signs are indefinite, but she has amenorrhoea, do not tell her she is not pregnant.

AT THE END OF THE FOURTH LUNAR MONTH OF PREGNANCY

Early in the fourth lunar month the uterus ceases to be a pelvic organ and rises into the abdomen. Several changes result on account of this. The uterus no longer presses on the bladder. Morning sickness in normal cases disappears. The cervix is pulled up with the rest of the uterus, and so it is more difficult for the fingers in the vagina to reach it. The uterus can also be felt in the abdomen, just above the pubes.

Other signs of pregnancy appear. *Increased pigmentation* is seen best in brunettes. A dark line of pigment known as the *linea nigra* is deposited in the mid-line of the abdomen, dark patches appear about the face, sometimes in a butterfly shape, the so-called pregnancy mask ("Chloasma Uterinum"). Other pigmented areas of the body assume a deeper tint. This increase of pigmentation is not very important. The other two signs are important. They are intermittent contractions of the uterus and internal ballottement.

Intermittent contractions of the uterus. This is

known as Braxton Hicks's sign. The pregnant uterus contracts intermittently. It is stated that the cervix shares in this general contraction. To get the sign, palpate the uterus bimanually. Feel the consistency of the uterus. If fortunate the uterus will get a little harder as the result of manipulation. There is a preparation of pituitary extract now on the market ("Pituisan") which, when injected intravenously, is said to make these painless contractions

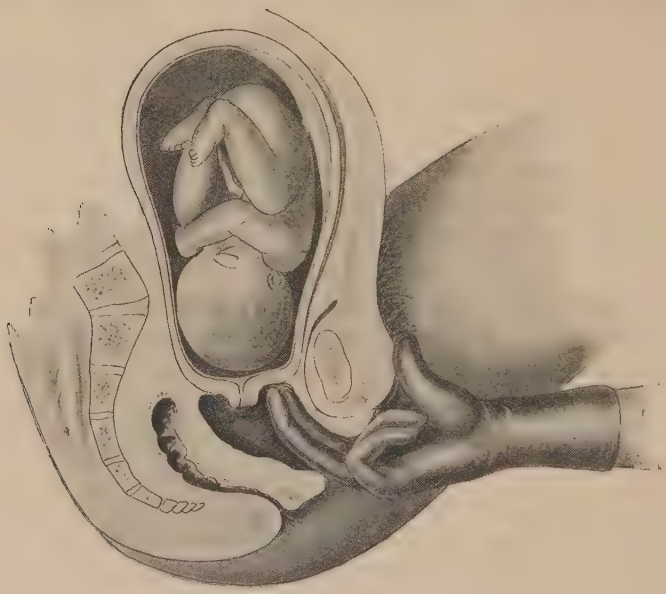

Fig. 21.—Internal ballottement.

more evident. The change is slight but definite, and may sometimes be felt better in one part of the uterus than another. The disadvantage of this sign is that unless manipulations excite a contraction, it may be necessary to wait for twenty minutes for a spontaneous contraction. If contractions are felt they are very strong evidence, and, taken in conjunction with the signs due to increased blood supply and with amenorrhoea, they are convincing. The contractions increase in strength until they become actually labour contractions. They are therefore particularly useful when examining a woman in advanced pregnancy, in whom doubt has arisen as to whether the tumour is pathological or physiological.

Internal ballottement (see Fig. 21). Internal ballottement is one of the foetal signs of pregnancy, and therefore a certain sign. It is due to the fact that the foetus is floating freely in liquor amnii. To get it, palpate the uterus bimanually. Having first passed a catheter, place one finger in the anterior fornix and steady the uterus against it with the other hand on the abdomen. Then push the finger up with a quick jerk and keep it holding up the roof of the anterior fornix. If a palpable part of the foetus were in contact with the finger, it is suddenly displaced. It floats up into the liquor amnii and returns to the finger that displaced it with a slight tap. This is ballottement. It is sometimes more easily obtained by passing the finger into the posterior fornix. The sign depends on a palpable part of the foetus being in contact with the fingers in the vagina. This is not always the case, therefore ballottement is not always demonstrable. If it is, it is certain that the patient is pregnant. Ballottement is present in normal cases from the end of the fourth lunar month. After the sixth lunar month ballottement by external palpation is as a rule quite easy.

Quickening. At the end of the eighteenth week, quickening may be felt by the patient. This is the first movement of the foetus that is felt by the mother. In primigravidae it is not a very reliable sign, but in multiparae it is a very useful guide in obtaining the date of the confinement. This is obtained by adding twenty-two weeks or five calendar months.

Longing or Pica. This is regarded as a symptom of pregnancy, and may occur at any time. The woman gets cravings for queer things like raw oatmeal, etc. Mild suggestion will effect a cure in most of these cases.

AT THE END OF THE FIFTH LUNAR MONTH OF PREGNANCY

The signs, in addition to the size of the uterus, that may be found at the end of the fifth lunar month are (1) Montgomery's secondary areola, (2) foetal heart sounds, (3) uterine souffle.

Size of the uterus (see Fig. 22). The uterus will be half-way between the pubes and the umbilicus. It may not

be easy to find it if the patient is very fat or keeps her abdomen very hard. To avoid the latter, palpate gently at first and gradually increase the pressure of the fingers to overcome the tense abdominal muscles. If the diagnosis is important and the patient will not relax, give an anaesthetic. If, when the abdominal muscles are slack, the large uterus cannot be felt, the patient is either not pregnant at all or the supposed period of her pregnancy is wrong.

Remember, too, when making a bimanual examination,

FIG. 22.—Height of the uterus at different months.

to examine for the other signs of pregnancy. Look for venous arborisations on the thighs, blueing of the vulva and vagina, and varicose vaginal veins. Feel for increased pulsation of the vessels in the lateral fornices, enlarged ureters, the soft, slightly patulous os, intermittent contractions, and demonstrate internal ballottement.

Montgomery's secondary areola. Some of the changes in the breasts in pregnancy have already been enumerated (see p. 52).

The relation between the breast signs and pregnancy is

difficult to estimate. There is either more circulation between the uterus and the breasts, possibly through some hormonic function in the former, or else there is a definite connection between the amenorrhoea, the formation of the corpus luteum, and the breast changes.

Foetal heart. The foetal heart can be heard by listening directly over the uterus, or by using a stethoscope or phonendoscope. It is usually first heard about the twenty-second week, and in the early months it is best heard immediately above the pubes. Attention will be drawn to the most favourable positions for hearing during the later months. Listen over the whole abdominal surface of the uterus. The foetal heart gives a faint tic-tac sound, usually compared with the sound of a watch heard ticking under a pillow. We have never heard it before the end of the fifth lunar month, and are very glad to hear it then. It is, of course, a certain sign of pregnancy. In the later months there is sometimes a "*funic souffle.*" This is a sharp, whistling sound, synchronous with the foetal heart-beat, heard in about 15 per cent. of cases. It is due, probably, to some obstruction in the circulation in the umbilical arteries.

Uterine souffle. This is another sound, and is heard at either side of the uterus—a soft blowing sound, synchronous with the maternal pulse. It is due, probably, to the passage of blood through the dilated uterine vessels. It is a probable sign of pregnancy, and helps with the other foetal signs to confirm previous convictions. It may also be heard in large uterine tumours.

REMAINING SIGNS OF PREGNANCY

Size of the uterus. The uterus is at the level of the umbilicus at the end of the sixth lunar month of pregnancy. At the end of the seventh it is three fingers' breadth above the umbilicus, at the eighth half-way between the umbilicus and ensiform cartilage, at the ninth it is up to, or almost up to the ensiform cartilage, and at the end of the tenth lunar month, owing to the falling down and forward of the uterus, it is again half-way between the ensiform cartilage and umbilicus. These positions apply with a good deal of

accuracy to primigravidae, but are not so reliable in estimating the time of pregnancy in multiparae.

Lineae or Striae Gravidarum (see Fig. 23). These are also known as *lineae albicantes* and are due to the stretching of the abdominal skin over the enlarging uterus. They show themselves as reddish or purplish-red lines radiating down directly from the umbilicus, and are due to subcutaneous ruptures of the elastic fibres with small haemorrhages into the tissues. These, after delivery, become white, due to scar tissue formation—hence the name *albicantes*. The

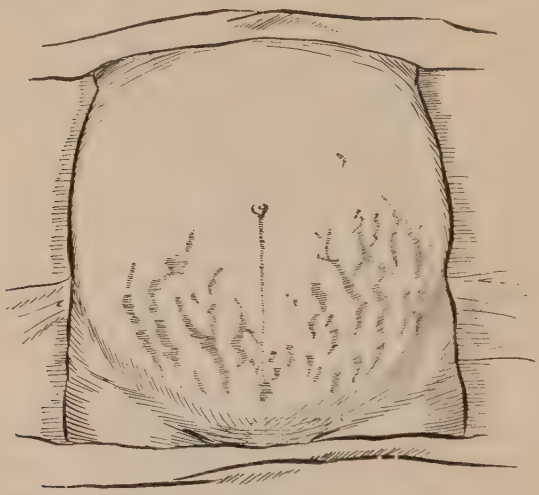

Fig. 23.—Striae gravidarum.

difference in colour—purple or white—serves to distinguish between a primigravida and a multipara. White lines are shown in the abdomen of the multipara : they are usually absent in the primipara.

Foetal parts and movements. The detections of foetal parts and movements are final signs of pregnancy, but are not usually observed before the sixth lunar month. To detect them, sit down on the side of the couch upon which the patient is lying; place the palms of the hands gently on the abdomen, and, gradually accustoming the abdominal muscles to examination, make little dives with the pads of the fingers. Go over the whole abdominal surface of the uterus. Foetal parts will be felt in this way,

and it may be possible to thrust them from the fingers by a sharp push—*external ballottement*; or, by placing the hands on either side of the uterus and pressing down suddenly, the foetus will be felt to jerk up in the space between the hands—another method of eliciting external ballottement; or the child may be pushed from side to side. Whilst examining, some part of the foetus may be felt or may be seen to move; or, whilst listening for the foetal heart, the gentle tap of a foetal limb may be heard.

Foetal movements may also be heard with the stethoscope. With regard to other possible and somewhat remote signs of pregnancy, excessive congestion of the mucous membrane of the *nose* must be mentioned. This is especially important in view of the cases of epistaxis which have been reported, several of which occurred in our practice.

Growing pains have been complained of, and are due probably to increased vascularity in the joints.

Biochemical tests for pregnancy. A note on these will be found in the Appendix. None of them has proved to be reliable.

X-rays. This method of diagnosing pregnancy must be mentioned, as it has been found of great benefit during the past few years. It has been claimed by Petersen that the X-ray in conjunction with an artificial pneumo-peritoneum gives a diagnosis in the sixth or eighth week. This is obtained by an observation of changes in the lower uterine segment. The rays are of service also in the diagnosis of difficult cases in the early months, *e.g.* when the abdomen is larger than normal in the first four or five months, where a differential diagnosis must be made between, *e.g.*, hydatidiform mole and twins. Fig. 288 illustrates such a case. The beginning of the fourth month is generally the earliest when the rays can give a positive result.

In the later months, when the foetal skeleton may be determined, the rays are increasingly of service in diagnosing the foetus from a tumour—especially when, owing to death of the foetus, there is no foetal movement. The rays are also useful in the diagnosis of foetal death. Figs. 290 and 291 show clearly the overlapping of the skull-bones which occurs in this type of case.

For fuller notes and illustrations on X-rays see Appendix, p. 732.

SUMMARY OF DIAGNOSIS OF PREGNANCY

At the end of the second lunar month the diagnosis is practically certain if Hegar's sign is present, or if there are several probable signs, such as blue vulva and vagina, vaginal pulsation, enlarged ureter, soft cervix, and breast signs, with amenorrhoea.

At the end of the third lunar month the above signs are more definite.

At the end of the fourth lunar month frequency of micturition, morning sickness, and Hegar's sign cease. The other signs continue, and intermittent contractions of the enlarged uterus and internal ballottement (certain sign) are manifest.

At the end of the fifth lunar month Montgomery's secondary areola, the foetal heart (certain sign), and the uterine souffle add their evidence, but are by no means constantly present.

At the end of the sixth lunar month, external ballottement, foetal parts and movements (certain signs) are present.

The size of the uterus corresponds to the time pregnancy has existed.

Diagnosis of pregnancy complicated by tumours or other conditions. Pregnancy is diagnosed by the signs already given. The aid of gynaecology, surgery, or medicine must be summoned to diagnose any other condition existing with it. One simple point is worth mentioning, namely, that the pregnant uterus, towards full term, flattens out the umbilicus, whereas fat and flatus do not.

Pseudocyesis, a condition of supposed pregnancy, is not uncommon in women who intensely desire offspring, especially sterile women approaching the menopause. Fat and flatus are the most frequent causes. These women often have the symptoms of pregnancy—morning sickness, abnormal or cessation of menstruation, quickening. The diagnosis is made by feeling a normal-sized uterus on bimanual or rectal examination, under deep anaesthesia if necessary.

Differential diagnosis of pregnancy. In addition to pseudocyesis, ovarian cyst, a circumscribed fibroid uterus, and a full bladder must be regarded as the chief differential points in diagnosis. A full bladder can be emptied, an ovarian cyst is soft and can be separated from the uterus and the pedicle felt, but it is often a matter of much difficulty to differentiate by diagnosis a circumscribed fibroid growth from a pregnant uterus. In the former the uterus is hard, the cervix is harder, there is no Hegar's sign, and the other symptoms of pregnancy are usually absent. Foetal parts are not distinguishable. In case of doubt, an X-ray photograph should be taken.

HOW TO PREDICT THE DATE OF THE ONSET OF LABOUR

The patient will ask not only if she is pregnant, but when she is likely to be confined. There are five ways of telling when a woman is likely to fall into labour. The first is by the date of the cessation of the menses; the second, from the time of quickening; the third, by the height of the uterus; the fourth, in the last weeks of pregnancy in a primigravida and the last days in a multipara, by the falling forwards and downwards of the uterus; and the fifth, by counting forward 280 days from the date of conception. Sometimes this is known, and it may be a matter of medico-legal importance to determine legitimacy. While the normal period of gestation is 280 days, the period may range between 260 and 290 days, and the law has determined that a child born 330 days from the day of coition is legitimate. For all practical purposes, 274 to 280 days may be taken as correct.

Post-maturity has a very important clinical interest with regard to induction of labour. A woman should not be allowed to carry her baby overtime, for she will have a difficult birth, with, perhaps, a dead child, therefore if a patient is seen at the end of forty weeks' pregnancy (and it is certain that the date is not incorrect), if the head just fits into the brim, labour should be induced by one of the many methods described (see p. 560).

From the date of the cessation of the menses. Although 280 days is the average duration of pregnancy,

this period is rarely accurate in any one particular patient. Conception is supposed to take place, as a rule, within the week following the cessation of the menses. Sometimes it takes place between the periods or immediately before the period. What has happened to a woman in one pregnancy is likely to happen to her in another, therefore if a patient tells us she was a week or more too early in a previous pregnancy, we are accustomed to deduct a similar period of time in calculating the duration of her present pregnancy. It is usual to add seven days to the first day of the last menstruation, and count back three months. By personal experience we have found this date too early in the majority

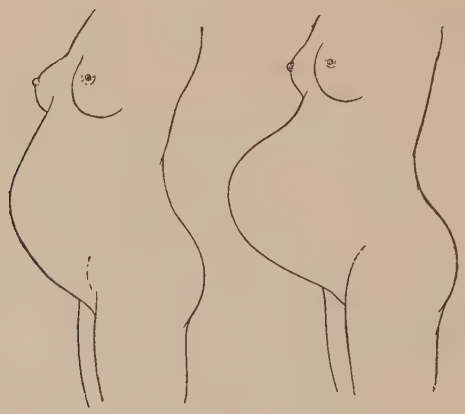

Fig. 24.—Falling down and forward of the uterus.

of instances, and have adopted the following rule. We take the date of the *last* day of the last period, add seven days to it, and count back three months. For example, if the last day of the last period was January 3rd, the addition of seven days makes January 10th, and counting back gives October 10th as the probable date of the onset of labour. This rule gives 280 days for nine months of the year, and the difference in other months, or in leap year, matters little, for 280 days is only an average. We find these predictions as accurate as those decided by more elaborate tables. For all that, the predicted date may be a fortnight too early or a fortnight too late. For this reason, if patients are coming up from the country to be

attended, it is advisable to ask them to arrive a fortnight before the calculated date.

Quickening. Quickening most commonly occurs in the eighteenth week. Add twenty-two weeks or five calendar months to the date of quickening. For example, if quickening occurred on June 4th, labour may be expected about November 4th.

The height of the uterus. The height of the uterus at different months has already been given. If the three reckonings from the cessation of the menses, quickening, and the height of the uterus agree as to the date of labour, it is well. But if they do not agree, rely principally on the reckoning from the height of the uterus.

Falling down and forward of the uterus (see Fig. 24). This is probably due to dilatation of the lower uterine segment providing new space for the liquor amnii, with consequent descent of the fundus, and at this time the head usually passes into the pelvis. This occurs about three weeks before the onset of labour in a primigravida, and about three days before labour in a multipara. It is, therefore, especially useful in a primigravida who is a month wrong in her calculations. Whether the uterus has fallen or not is recognised by placing the palm of the hand on the fundus. If the uterus has fallen down and forward, the fundus forms a definite shelf, and this is very different from the gradually receding fundus before the uterus has fallen. Before it has fallen, the large uterus of the ninth lunar month obstructs the action of the diaphragm, and may cause the patient difficulty in breathing. She may have to be propped up by pillows at night. Subsidence relieves this, and she will say that she can now breathe freely at night, but that—and this is owing to the sinking of the head into the pelvis—she has to pass urine more frequently, has pain in the legs, sometimes oedema, greater difficulty in moving about and getting in and out of bed. Rely chiefly on this occurrence of sinking of the uterus in primigravidae. It is often not definite in multiparae, and occasionally does not occur in primigravidae. These are the cases we will refer to in connection with contracted pelvis.

CHAPTER V

A NOTE ON ANTENATAL CARE—THE OBSTETRIC KIT

ORGANISED antenatal care is an essential to properly conducted midwifery either in hospital or private practice.

That hospitals and private individuals are prepared to give such care is now the rule, but much remains to be done in the education of the public, not only to attend, but to attend earlier in pregnancy than is at present the habit. Much can be done both by hospitals and private individuals to make antenatal care more general, and there can be no doubt that the advantages gained by systematic and thorough work of this nature will reduce (*a*) maternal mortality and invalidism, (*b*) foetal mortality and the number of neo-natal deaths; and, in addition, emergency midwifery operations will be reduced in number, so that the doctor will benefit from his work during the day by increasing his chances of undisturbed repose. It seems to us essential that panel practitioners should be paid for antenatal management, that the general practitioner should include antenatal care in a composite fee, if good results are to be achieved.

At the Rotunda Hospital the average number of confinements attended in the intern and on the extern is nearly 4,000 per annum, and of these cases, 1,000 are receiving antenatal care. This involves three dispensaries per week, which take at least two hours to conduct, which illustrates that the thorough antenatal care, if all patients delivered in the service attended, would involve twenty-four hours per week, or four hours per working day; this serves to illustrate the tremendous undertaking that efficient antenatal work involves. In spite of much endeavour, it is a regrettable fact that it is impossible to get all patients to seek antenatal care. It is to be understood that such clinics are attended by a large class of post-graduates and students, which causes a certain amount of delay.

The reduction of mortality by antenatal work is due mainly to the opportunity of early diagnosis and treatment of those very important conditions, *i.e.* disproportion, toxaemia, and syphilis. In addition, the proper regulation of hygiene during pregnancy will reduce the incidence of toxaemia, and enable women whose constitution is affected by general disease to withstand the strain of childbirth.

Under other headings will be found full accounts of the various complications met with during pregnancy; the object of this section is to outline the work that may be carried out in the doctor's study or in an out-patients' department. Such work is necessarily limited, and the time devoted to it is also limited, and must be expended to the best advantage; therefore it is essential to classify the important conditions that may be met with, in order that their recognition or exclusion may become easy.

These conditions fall under two main headings:

1. Those present before the pregnancy commences:

General.	Cardiac disease.
	Renal disease.
	Tuberculosis.
	Syphilis.
Local.	Malposition of the uterus, cystocele, rectocele.
	Tumours of the ovary.
	Tumours of the uterus.
	Gonorrhoea.
	Contracted pelvis.

2. Those arising during pregnancy:

General.	Toxaemia.
	Pyelitis. Cystitis.
Local.	Ectopic pregnancy.
	Missed abortion. Miscarriage and labour.
	Blood mole.
	Hydatidiform mole.
	Hydramnios.
	Malpresentation.
	Prolonged gestation.

It is to the advantage of patient and doctor that the first visit should be made shortly after the first missed period,

when conditions included in the first group can for the most part be definitely excluded or diagnosed, and where treatment in the latter case is indicated it can be commenced.

A bimanual examination should be made under certain circumstances—to exclude pelvic tumours, malposition, ectopic pregnancy, and the various degrees of abortion.

The urine is tested for albumin, and, where indicated, for pus. The blood pressure is recorded and the external measurements are taken.

The patient is given directions, such as are outlined in the chapter on pregnancy, and is requested to return each month with a specimen of urine.

Such visits are regarded by some as unnecessary and unpleasant to the patient, but the value of checking the height of the fundus, noting the date of quickening, and establishing the presence of the foetal heart may be considerable in many cases.

It is during the middle months of pregnancy that pyelitis may make its appearance, and pain in the abdomen during pregnancy should direct the attention to the urine, as many serious conditions may be avoided at the outset by alkalinising the urine.

It is exceptional for albuminuria to appear before the twenty-eighth week, and when it does, it is usually in multiparae with previous renal damage suggested by their previous obstetric history. When in primiparae, the same diagnosis of chronic nephritis should be thought of, and in these cases prognosis should be guarded and treatment extremely thorough. An acute fever during pregnancy (such as influenza) is liable to result in nephritis.

From the twenty-eighth week onwards a weekly attendance with urinanalysis is necessary, as the likelihood of toxaemia increases towards term.

At the thirty-fourth week a careful abdominal palpation is made; the diagnosis of malpresentation, such as breech or transverse, will result in treatment by external version if indicated. These cases should be observed twice weekly, for until the thirty-sixth week recurrence is likely.

Cases of malpresentation met with nearer term are more

difficult to correct, but the liability for them to recur is reduced.

Breech in primigravidae is sometimes very difficult to correct, and where an anaesthetic is necessary, extreme care must be exercised to avoid injury to the placenta resulting from prolonged or violent efforts. X-ray diagnosis of the extended position of the legs will be a warning of the difficulty in version that is experienced in such cases.

Those cases which are impossible to turn, and in which difficulties may be expected in labour, may have labour induced before term.

Transverse presentation is often very persistent and recurs after version more often than not. Such cases are safer to be in hospital a week or so before term, in order that prolapse of the cord may be avoided. Another method to prevent that occurrence is to induce labour by bringing down a foot, but this is seldom indicated.

Third and fourth vertex presentation should be suspected where the head in a primipara is high (comparatively near term) where the pelvis is apparently normal. Rotation of the back may sometimes be effected, but in many cases the accuracy of palpation is not sufficient to direct diagnosis or treatment.

Face and Brow presentations are rare, and it is doubtful if they are ever present during pregnancy. Schatz's method may be applied, but needs anaesthesia.

Contracted pelvis may be suspected where the external measurements are reduced below 23, 26, 18 centimetres, or where the interspinous and intercristal approximate.

Other considerations are more important than the external measurements: the previous history in multiparae, the stature and gait, the skeletal changes due to rickets. In multiparae a history of previous confinements where it can be accurately obtained is of extreme importance, and the points which are most likely to be overlooked are the weight of the baby, and the period at which labour took place.

In primigravidae when the head is not deeply engaged at the thirty-seventh week, disproportion is at once suggested. External measurements may be normal. Before the thirty-seventh week the degree of mobility of the head or actual

over-riding, combined with other signs such as pendulous abdomen, may be indications to carry out a detailed examination of the pelvis under anaesthesia, including Skutsch Pelvimetry and estimation by the Müller, Munro Kerr and Solomons methods.

Where induction of labour is the method of treatment adopted, care is needed to ensure that the period of pregnancy is accurately estimated, as sometimes a free unfixed head at the thirty-fifth week (normal) is mistaken for unfixed head at the thirty-ninth week.

Cases will be therefore divided up into those which justify Induction of Labour, those which are to be given a Trial of Labour, and those cases in which Caesarean Section is obviously necessary before the onset of labour.

The last type of case is usually a primigravida, and the head in such cases may be very free, or even a transverse presentation may exist, and therefore it is advisable for such patients to be in hospital before the expected onset of labour. Cases which have previously been sectioned must be definitely warned of the danger of delaying at home after the labour comes on, as rupture of the uterus through Caesarean scar is unfortunately not very rare.

Toxaemia. The question of Hyperemesis is dealt with elsewhere. In mild cases the pulse rate over 90 is an indication for further urinoscopy. Albuminuria may not be present in the early stages. Acetonuria makes its appearance early.

Albuminuria is the best sign to rely on as an indication of toxaemia, although toxaemia is occasionally present without albuminuria, and even where it may indicate a chronic renal condition exacerbated by the pregnancy, the seriousness of it is not decreased, and so routine examination of the urine is a good safeguard against the occurrence of eclampsia.

Symptoms attributed to toxaemia may be evident, but often are absent, and though important in directing attention to the possibility of toxaemia, their absence should not create a sense of false security where the urine has not been examined.

The blood pressure is usually raised in association with

albuminuria, but more important is the presence of hyperpiesia without albuminuria, because it may direct attention to important previous history of renal disease, or of still-births, accidental haemorrhage, or even eclampsia.

Where cases have a high blood pressure—160 or over—at the outset of pregnancy, the liability of early development of albuminuria is to be looked for, and that symptom may be soon followed by death of the foetus, or other more severe toxaemic symptoms. Where there is a history of repeated dead foetus associated with albuminuria, the most careful dieting during pregnancy, and induction of labour when the foetus is still alive and viable, offers the best line of treatment.

The treatment for albuminuria is detailed on p. 201. It is the duty of the doctor to see that albuminuria is not overlooked or passed over as a sign of minor importance.

Syphilis has been a potent cause of still-birth and early infantile mortality in the past. The introduction of the Wassermann reaction and treatment with neosalvarsan has been a tremendous advance.

It remains, therefore, for the attendant to diagnose syphilitic cases before the fifth month, for treatment started before that time gives excellent results.

In primigravidae, any rash, however slight, any vulvitis or vaginal discharge, should urge the necessity for the blood to be taken for examination ; moreover, any patient who is unmarried, or was unmarried at the time of conception, should arouse suspicion.

In multiparae a typical history associated with a positive Wassermann is often met with, but occasionally the history suggests syphilis, while the Wassermann reaction may be negative even after a provocative dose of NAB. Such cases deserve a trial of antisyphilitic treatment, and a large proportion respond by going to term and having a living infant.

Finally, a woman who has had abortions or difficulty of any sort in labour should be instructed to attend regularly an antenatal clinic throughout her next pregnancy.

THE OBSTETRIC KIT

The practitioner must decide on the best way to carry his kit. There are several entirely satisfactory methods, and these will be mentioned.

(1) The kit may be carried in a kit-bag (see Fig. 25) with sterilisable lining, and with instruments, gloves, etc. already sterilised. This is the method we adopt in private practice, and it is admirable when one is attached to a hospital where everything can be prepared in the theatre. It saves trouble and time. When an urgent condition is

Fig. 25.—Bag for obstetrical kit.

present, there is no time lost in waiting to sterilise instruments.

(2) The kit may be carried in a kit-bag unsterilised. This is very satisfactory where the doctor is not connected with a hospital. A steriliser or fish-kettle must, however, be brought along, and this takes up room in the bag.

(3) In the Extern Maternity Department of the Rotunda a steriliser is carried in a canvas case. The steriliser is so adapted that it can be used either as such or as a douche can. It is illustrated here (see Fig. 26). It has the advantage that in a big practice where there may not be time to get instruments prepared between confinements, the steriliser is ready to hand. It has the disadvantage that it is very heavy. Also the bag method of carrying

sterilised instruments and using a rubber douche bag is altogether satisfactory in private practice.

The bag and its contents. Provided it is decided to

Fig. 26.—The kit of the Extern Maternity Assistant at the Rotunda Hospital. A description of the various instruments will be found in the text.

choose a bag, buy one that will hold conveniently all requirements. It should measure 20 inches by 8 inches. It should be so made that it remains open by stays (see Fig. 25). It should have an inside lining which can be taken out and boiled, for it is difficult to keep a leather

bag clean unless this is done. The instruments are carried already sterilised, in sterile cases. We bring to an ordinary midwifery case the following :—

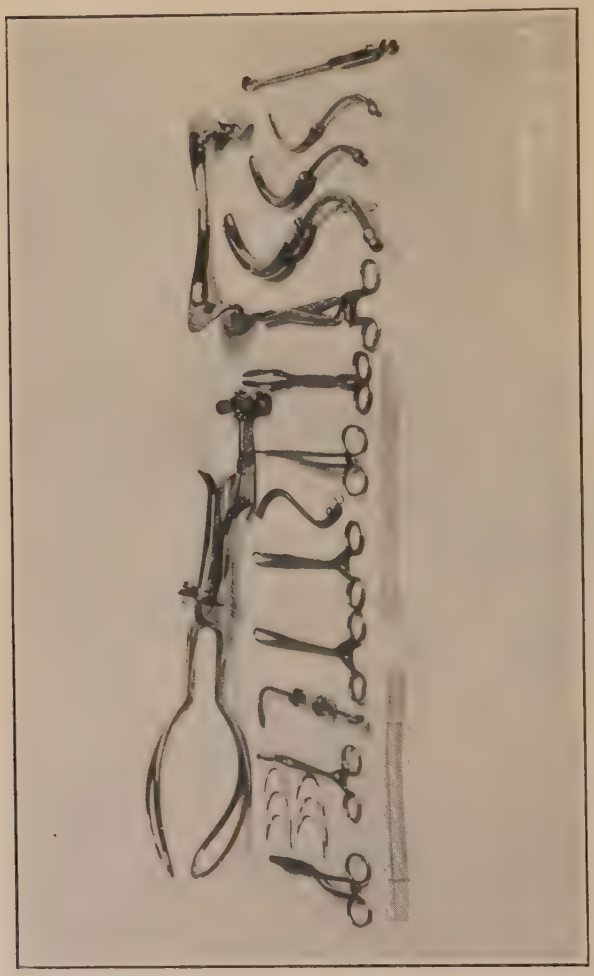

FIG. 27.—Kit for private cases.
The instruments are :—Above—Obstetrical forceps and duckbill speculum.
Middle row—Left to right—Needle holder, needles, ring forceps, mucus catheter, two bullet forceps, catheter, plugging forceps, ovum forceps, Schultze spoon forceps, three Bozeman catheters, Rheinstädter's flushing curette.
Lower row—Two glass nozzles.

Instruments :

Sponge forceps.
Catheters.
Two glass nozzles (in case one gets broken).
Barnes' forceps with Neville's axis-tractor.

These are carried in a separate case, so that it is only

necessary to open the one package at a simple forceps operation.

In the second case are :

Sponge forceps, catheter, two glass nozzles.

Two bullet forceps or ring forceps.

Posterior speculum.

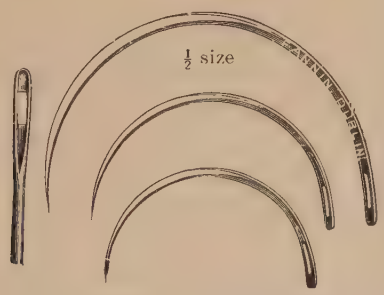

Fig. 28.—Large and small curved needles.

Three Bozeman's catheters.

Rheinstädter's flushing curette.

Plugging forceps.

Schultze spoon forceps.

Ovum forceps.

Catheter with stilette.

Fig. 29.—Box for sterile needles.

This then is ready for any emergency, *e.g.* accidental haemorrhage, post-partum haemorrhage, etc.

The three Bozeman catheters are of different sizes, one for abortion cases, the second in case of douching in the puerperium, the third a very large instrument for post-partum haemorrhage.

The Schultze forceps, the ovum forceps, and the Rheinstädter curette are alternative instruments for the treatment of abortion.

A stitching kit, comprising two or three large perineal needles, two or three cervix needles, needle-holder, three artery forceps.

These three cases thus contain the instruments necessary for any ordinary obstetrical emergency. We do not carry destructive instruments: craniotomy is rare in our practice, and we can get the cephalotribe when required.

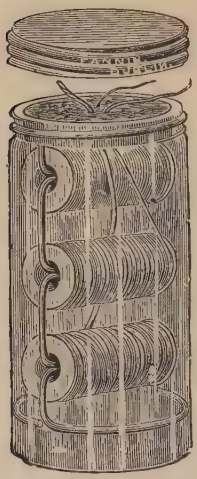

Fig. 30.—Sterilized catgut in bottle.

There are other necessaries which are also in the bag:

(1) A mucus catheter. In private practice we use our own extractor, which is chiefly of glass: we can see the mucus and do not suck it into our mouth.

(2) Rubber douche bag. This is brought already sterilised in a case.

(3) Hypodermic case and two syringes.

(4) Strong silkworm gut, dyed in methylene blue, is brought in a glass jar in biniodide of mercury.

(5) Catgut of four sizes, in tubes or else already sterilised in a bottle (see Fig. 30).

(6) A knife.

(7) Breast infusion apparatus. This is brought already sterilised. One with two needles is advised.

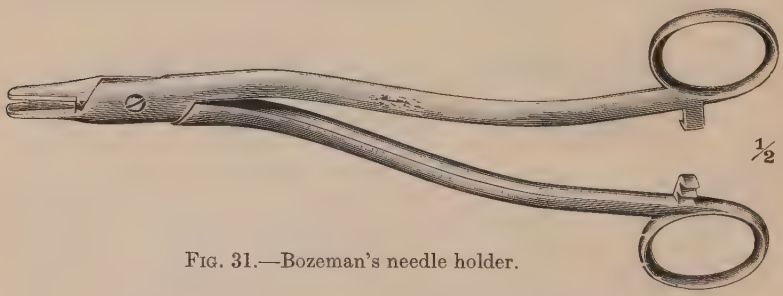

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Fig. 31.—Bozeman's needle holder.

(8) Chloroform bottle. A metal one as illustrated (Fig. 94) is preferred. It never leaks, and keeps the chloroform fresh (out of light).

(9) Ether in a glass bottle in a metal case.

(10) Rubber gloves. Two pairs at least.

(11) Soap and soap dish. We always carry our own soap to a private house. We avoid antiseptic soaps, which make the skin rough. Good soap is made by boiling, therefore if the outer surface is washed off, it can be safely used.

(12) Chloroform mask.

(13) Dusting powder for the cord. This is not absolutely necessary. We use, as a rule, Woolley's Sanitary Rose Powder.

(14) Nail brush. This must be boiled before use.

(15) Biniodide of mercury tablets.

(16) Binder pins.

(17) Lysol and Cyllin. One bottle of each.

(18) Tabloids of sodium chloride.

(19) Thread for tying the cord.

(20) Iodoform gauze. Dührssen's tin may be used, or else a large jar of sterilised gauze can be bought.

(21) Cotton wool.

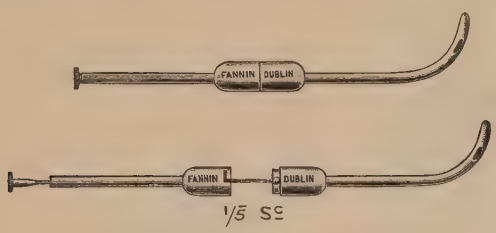

Fig. 32.—Mucus catheter.

(22) A large apron to cover upper arms and to reach down to feet.

(23) A sterile coat.

(24) Some sterile sheets.

(25) A medicine glass.

(26) Silver nitrate in drop bottle.

(27) An extra pair of scissors.

(28) Enema syringe.

(29) A piece of thin waterproof 3 feet by 4 feet, to form a mackintosh on which the patient can lie if she has not already got one in the house.

On arriving home from a case, we immediately sterilise our instruments. Care must be taken that they are taken in pieces, scrubbed carefully in cold water and boiled. Do not allow them to be boiled with any old blood on them. The instruments are then boiled, dried while hot, and put into their cases. The waterproof apron and sheet are scrubbed with a brush in soap and water, boiled, and hung

up to dry. The gloves are boiled, dried, and powdered inside and out with baked chalk to prevent them sticking.

In attending certain cases additional care against dirt is necessary. A clean newspaper on the table is better than a dirty cloth. Carefully cleanse all basins and jugs which may be required by rubbing them with wadding soaked in biniodide of mercury or crude lysol.

For a diaper, boil a piece of linen or calico and soak it for fifteen minutes in biniodide of mercury (1–2000).

Fig. 33.—Douche bag.

This seems rather a large list, and the only things to add to it are certain drugs which may be necessary for the patient.

(1) Ergot. We now use femergin (ergotamine tartrate) either in ampoule or tablet form; we carry both.

(2) Camphor in oil. One box of 1 c.c. ampoules.

(3) Pituitary extract. One box of $\frac{1}{2}$ c.c. ampoules.

(4) Strychnine. gr. $\frac{1}{30}$.

(5) Digitalin. gr. $\frac{1}{100}$.

(6) Morphine. gr. $\frac{1}{4}$ and gr. $\frac{1}{6}$.

(7) Atropine. gr. $\frac{1}{100}$.

(8) Hyoscine. gr. $\frac{1}{100}$.

(9) A 2-oz. bottle of brandy.

(10) A 2-oz. bottle of ether.

It will be seen from the above description that there are several good methods of carrying the kit. The practitioner can take his choice. For our part, the bag method, with separate cases for instruments, is our first choice in private practice. For hospital work the douche-can is the best.

There are certain instruments which we have not mentioned, but which are alternative to those already referred to.

The Rotunda Douche. We have nearly discarded this for the douche bag, but as some practitioners still remain true to it, and examiners have a habit of asking the unwary student about it, a description of its use is given here. The rubber bag (see Fig. 33) is easily sterilised by boiling and is

simple to use, while the Rotunda douche is more liable to need repair.

The Rotunda douche (see Figs. 34, 35) acts on the principle of a siphon. It is made of stout rubber, so that it may be

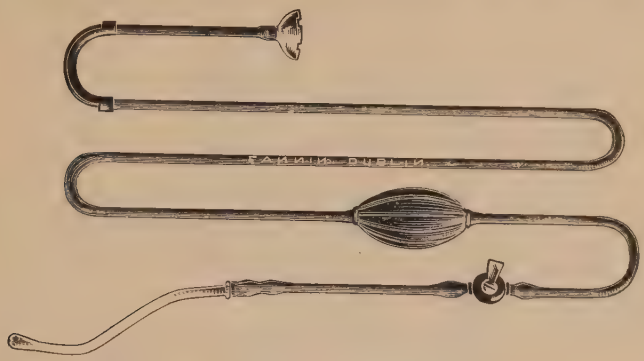

Fig. 34.—Rotunda douche with glass nozzle.

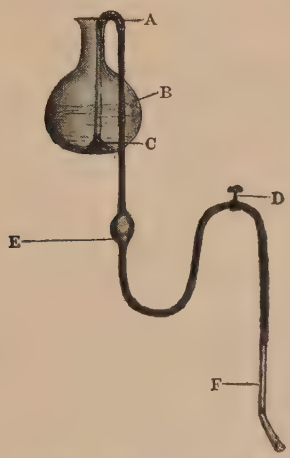

Fig. 35.—The Rotunda douche in use. A, curved metal tubing through which the rubber tubing runs; B, vessel holding douching fluid; C, weighted plunger attached to tubing and resting on bottom of vessel; D, stop-cock; E, pressure bulb for starting the flow; F, glass douche tube.

boiled. An ordinary clean jug is used as douche-can. Put the sinker into the jug and hang the curved metal protector over the edge. The curved metal protector prevents the tube kinking. Squeeze the ball chamber and empty it of air. Then allow it to fill with douche fluid from the jug. Turn on the stop-cock. This starts a continuous siphon action.

It is well to try it once at home before using it at a case. Its advantages over a douche-can are its lightness and portability.

Tottenham's modification of the Rotunda Douche (see Figs. 36, 37).—This possesses some advantages. The

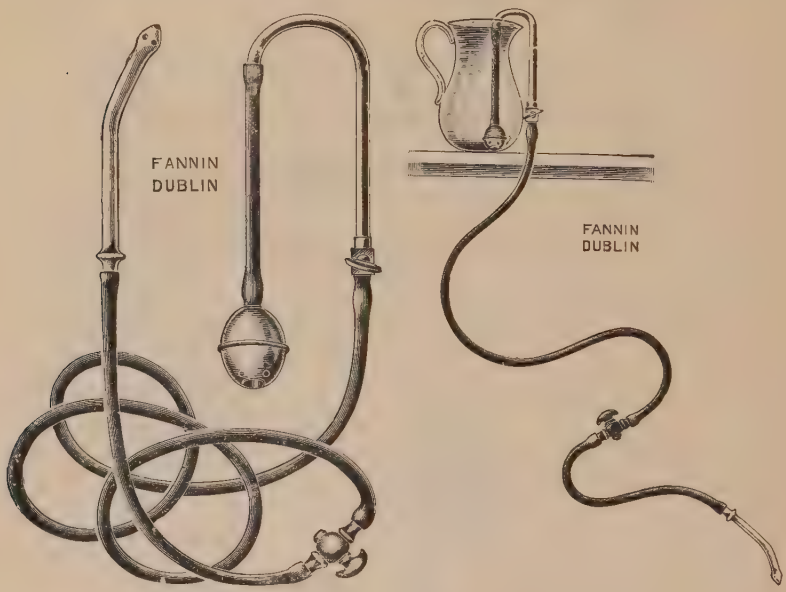

Fig. 36. Fig. 37.
Tottenham's modification of the Rotunda douche.

portion going over the edge of the jug is all metal, and the douche, being made in separate parts, is easier to keep clean; if necessary any portion can be renewed. In order to start the flow, the tube is pinched in the left hand, while the right thumb and forefinger are drawn downwards, compressing the tube as they go. While the tube is still being compressed, the pressure by the left fingers is relaxed, and the water is drawn up by the vacuum created. As soon as the tube is full, the flow starts. It can be fitted with a bulb if desired.

CHAPTER VI

LABOUR: ITS PHYSIOLOGY

PRESENTATION AND POSITION OF THE FOETUS

THE foetus forms a somewhat pear-shaped body which adapts itself to the shape of the uterus. When it is traced from above downwards it is found that in its normal attitude the head is flexed so that the chin rests on the breast, the arms are crossed over the chest, the umbilical cord lies between them, and the legs are bent on the thighs, with the arches of the feet resting on the anterior surfaces of the legs. Fig. 38, which shows the back behind, illustrates the normal attitude adopted.[1]

Presentation. This may be defined as the relation which the long axis of the foetus bears to the mother.

The Presenting Part is that part of the foetus which lies lowest in the parturient canal.

In other words, the presentation, when *longitudinal*, may be either some portion of the head or the breech. When the presentation is *transverse*, the presenting part may be shoulder, abdomen or back.

The Longitudinal Presentations. These may be head or breech. The head presentations are divided into:

(*a*) Where complete flexion is present—Vertex presentation.

(*b*) Partially flexed when the large fontanelle presents – Sincipital or anterior fontanelle presentation.

(*c*) The head may be extended—Face presentation.

(*d*) Partially extended—Brow presentation.

The different varieties of Breech presentation are described on p. 358.

Position. This is the relation which the back of the foetus bears to the abdomen of the mother.

[1] It must be clearly pointed out that this illustration demonstrates the normal *attitude* of the foetus, not the normal *position*.

We adopt the above definition. In some countries the occiput, chin, and sacrum are used as the determining points with regard to position, but we find the "back" method the simplest. This is dealt with more fully on p. 111.

Why does the head present? This is due to two causes: (1) gravity, (2) the shape of the uterus.

The actual presentation is not determined until nearly the end of pregnancy, and the nearer to term the more definite will be the presentation, *e.g.* it is usually a futile

Fig. 38.—Vertex III.

proceeding attempting to change a position before the thirty-sixth week.

Gravity. Following the experiments of Duncan, Veit, and Schatz, it has been found that when a foetus is suspended in fluid of the same specific gravity as the liquor amnii, the head is inclined to sink to the lower end. In addition, while the head of the foetus is lighter than the breech in the early months, it is heavier in the last two months.

Shape of the uterus. In addition to gravity, the somewhat pear-shape of the uterus must be taken into consideration. It is perfectly obvious that the larger upper part of the uterus must accommodate the breech of the foetus, for in this portion there will be room for it to move

about, *i.e.* that reflex movements of the foetus take place until it is in a comfortable position.

We may conclude, therefore, that because of gravity, somewhat, and because of the shape of the uterus to a large extent, head presentations are most common.

Why are left positions more common than right? In other words, why does the vertex engage in the right oblique diameter more often than the left? This is believed to be due to the encroachment on the left oblique diameter by the pelvic colon and rectum. That is, the first and third positions are the most common. But the first is more common than the third, because the foetus is more comfortable with the back anterior, for the front portion of the foetus is more adaptable to the vertebral column of the mother than the foetal spine.

LABOUR

Labour may be defined as the process which separates the ovum from the mother.

Normal. A labour may be considered normal when the vertex presents and the child and after-birth are born without complication, and without any mechanical help, within twenty-four hours of the onset of labour.

It used to be customary to classify abnormal labours, but we regard this as artificial, and of no practical aid.

Duration of labour. Labour is very variable in its duration, and the average must be taken—generally speaking, eighteen hours for a primigravida, and twelve hours for a multipara may be regarded as correct. At the same time it must be emphasised that a labour may be without danger or difficulty to a patient although the duration, for example, may be thirty-six hours in a primigravida.

PHYSIOLOGY OF LABOUR

Cause of onset. This is not known. There are various theories, some of the more plausible of which are given below:

1. The uterine contents become too big for the uterus.

Thinning of the uterus in the last months, and formation of the lower uterine segment, are both partly due to the

growth of the ovum having outpaced that of the uterus. The increasing distension stimulates the uterus more and more until the climax is reached. As evidence in support of this, premature birth in the case of hydramnios and multiple pregnancy may be mentioned.

2. Pressure on the cervical ganglion.

The increasing pressure exerted by the lower pole of the ovum, firstly leads to the formation of the lower uterine segment, and secondly, by pressing on the cervical ganglion, plays a part in the onset of labour. The fact that women with contracted pelvis (where the head is unable to exert this pressure) frequently carry their children over time supports this view.

3. Increase of strength in the painless contractions, with increased irritability of the uterus.

Braxton Hicks described spontaneous painless contractions of the uterus, and they have come to be regarded as one of the reliable signs of pregnancy. The contractions gradually increase in strength towards the end of pregnancy, until finally they open the internal os and start labour. The general irritability of the uterus is especially marked at or about the time at which the patient would menstruate if not pregnant, hence there is a likelihood of labour setting in on the menstrual date which would have corresponded to the maturity of the foetus.

4. The endocrine system.

Of late it has been customary to invoke the aid of the endocrine system in order to explain physiological occurrences which have hitherto defied explanation.

In the case of labour there are more than likely to be several internal secretions directly or indirectly concerned. That it is not merely an outpouring of pituitrin, although hypertrophy of the pituitary gland is constant, is evident from the more or less general failure of this substance to induce labour, save at full time only, and then in combination with other stimulating drugs. The sudden upset of the endocrine balance in fright or shock may bring on labour. The secretion of the corpus luteum prepares the uterus for pregnancy, the stopping of the secretion may prepare it for labour. In other words, a possible reason

for the onset of labour is a sudden increase in pituitary secretion excreted by the ovary, in consequence of the regression of the corpus luteum, *i.e.*, regression earlier than the seventh month.

5. Increase of CO_2 in the placental sinuses.

Leopold has shown that many placental sinuses are obliterated towards the end of pregnancy; this will result in the remaining sinuses having to carry a greater percentage of CO_2, and this increase of CO_2 has been suggested as a cause of the onset of labour.

6. Decidual changes.

It has been suggested that the decidua in the last weeks of pregnancy undergoes fatty degeneration: also that the septa bounding the glandular spaces become thinner and show a tendency to rupture, with consequent separation of the ovum. This theory has very few adherents.

7. Menstrual periodicity.

It is well known that the time of menstruation is the most likely for abortion to occur. Bearing this fact in mind, it is easy to understand that after some months labour would be more likely to start at a periodic time than at other times.

8. Senility of the placenta.

The presence of infarcts in the placenta has suggested the theory that senility has occurred—that metabolic products from the foetus due to faulty nutrition may stimulate uterine centres.

The above are the chief theories. There are various others which are too vague to allow any real cognisance to be taken of them.

The Forces concerned in Labour with the Changes in the Uterus. The Lower Uterine Segment.

The first of the forces to be considered is the effect of uterine contractions. Following on the painless contractions of Braxton Hicks already referred to, contractions accompanied by pain (true labour pains) come on. These pains are entirely involuntary, but are definitely psychological, as shown by the fact that they sometimes pass away when the doctor is in the room.

Uterine contractions are essentially involuntary. At the beginning of labour each pain is weak, occurs about every half or one hour, soon it reaches its acme; this is maintained for a short space of time, then the contraction gradually dies away. During the intervals the shape of the uterus is somewhat ovoid, and is flattened by the abdominal walls; when, however, a contraction sets in, the uterus becomes somewhat globular in shape, with the result that the antero-posterior diameter is increased at the expense of the transverse; the body of the uterus is elevated from the vertebrae, the fundus pushing forwards the anterior abdominal wall; thus the long axis of the cavity is made to coincide more nearly with that of the axis of the pelvic inlet. The pulling forward of the body is due mainly to the round ligaments. The round ligaments are directly continuous with the external layer of uterine muscle, and by their aid a direct pull is obtained during a contraction. It is important to remember that in labour the bladder is drawn up, hence it is more likely to be wounded if the abdomen be opened carelessly. The expulsive efforts of the uterus are considerably augmented by the action of the abdominal muscles. At the beginning of labour the patient does not bear down; as labour advances there is an ever-increasing impulse to do so, and in the end this impulse is often beyond control. The reasons are that the upper part of the uterus becomes shorter and thicker, a great part of the child is below the retraction ring, the abdominal voluntary and involuntary expulsive forces are employed, and the uterine contents tend to become extruded from the cavity.

There is another important result of the increased intra-abdominal pressure, namely, hyperaemia of the vagina and immediate neighbourhood, which leads to the considerable outpouring of a secretion which, by acting as a lubricant, facilitates delivery.

The degree of pain experienced increases with the dilatation of the internal os and taking up of the cervix, and is in part due to the disturbance in the tissue bundles, which, after forming the sphincter of the os, radiate outwards to form the pelvic diaphragm. The pain usually starts in the sacrum and then may radiate in various directions. During

a contraction there is a rise of blood pressure and an increase of pulse rate, but these return to normal during the interval, therefore the pulse rate as a guide to the patient's condition is of little value when she has a pain; when it is over, a more accurate result will be obtained.

The secretion of urine is increased, and therefore it is necessary to empty the bladder more frequently than normally. The pressure to which the foetus is subjected tends to drive it in the direction of least resistance, that is, the region of the lower uterine segment; preceded by the bag of membranes, the foetus dilates the cervical canal progressively from above downwards. That the bag of membranes plays a very important part in the dilatation is evidenced by the length of time the os takes to dilate when the membranes rupture at the start of labour. The bag is able to pass through the internal os and open it mechanically after the manner of an instrumental dilatation, whereas if the head is left to accomplish this unaided, it has to rely on the uterus to pull the cervix up over it, after the manner in which a sweater is pulled on over the head.

As labour passes through its stages, various phenomena occur. The *first stage* is the stage of dilatation, and starts with the onset of *true* labour pains, and ends with the full dilatation of the cervix.

The os opens slowly and gradually, the membranes protruding through it and pressing on the sides of the cervical canal. As labour advances there is a considerable degree of tension exerted on the external os in primigravidae, it being the last portion to dilate, hence its border becomes thin and sharp, the whole cervix being dome-shaped and accurately applied to the convexity of the foetal head. This thinning-out process is generally known as the taking up of the cervix. It must be clearly understood, therefore, that the first stage consists of dilatation with taking up of the cervix. In multiparae the process differs, since the connective tissue of the external os has usually been torn in a previous labour, and hence the external os opens with or before the internal os (see Figs. 39-44). The tension on the cervix is reduced during the intervals between the pains, and the membranes go back. Each

successive contraction succeeds in dilating the os more and forcing the membranes further down. The thin stretched

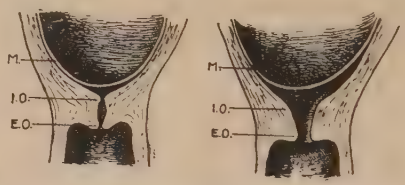

FIG. 39.—Diagram to show detachment of membranes when the os begins to open.

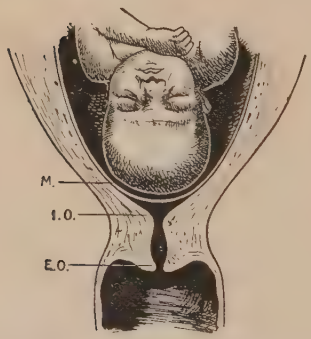

FIG. 40.—The closed cervical canal before the commencement of labour. M, membranes; I.O., internal os; E.O. external os.

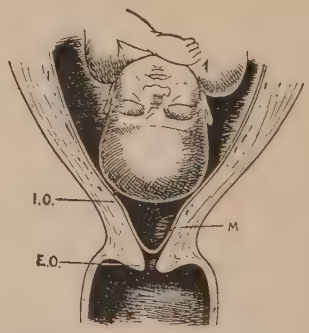

FIG. 41.—The cervical canal of a primigravida opening.

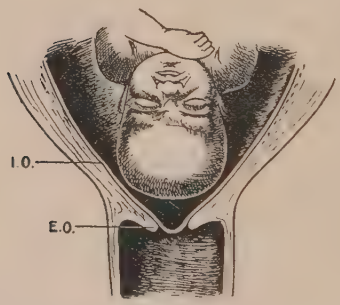

FIG. 42.—Further stage of the opening of the cervical canal of a primigravida.

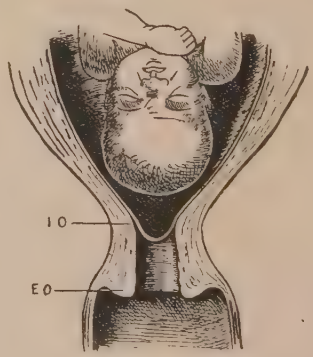

FIG. 43.—The cervical canal of a multipara opening.

edge of the os frequently tears to a greater or less extent, and evidence of this having occurred may be gathered from the appearance of a blood-stained discharge on the complete

dilatation of the os. The pressure on the bag of membranes becomes increased, and as they do not become relaxed between the contractions, their rupture is generally only a matter of a few minutes. The child's head divides the amniotic fluid into two portions, that below the head being known as the fore-waters, and that above, as the hind-waters. Immediately on rupture of the membranes fore-waters escape, and hind-waters are retained by the somewhat valve-like action of the descending head, which is now able to come through the cervix, the walls of which are flush with those of the vagina. In malpresentations there is frequently a too rapid escape of the hind-waters owing to the presenting part not accurately filling the pelvis.

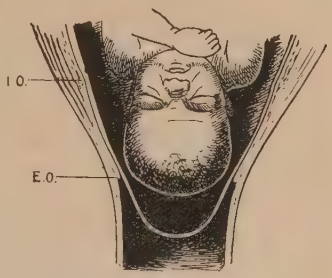

Fig. 44.—Cervical canal fully opened.

The *second stage* commences with the full dilatation of the cervix, and ends with the birth of the child.

The rupture of the membranes is frequently followed by a longer interval before the next contractions. When these start they will be noticed to differ somewhat from the foregoing, in that the patient involuntarily bears down, and does so more forcibly when the advancing head reaches the pelvic outlet. The advancement with each subsequent pain is associated with a bulging of the perineum; the labia begin to gape until finally the head is visible; later, between the pains, the pressure to which the rectum is subjected results in faeces being passed; this is always a sign that delivery is imminent. The perineum becomes extremely thinned out. During the delivery of the head the anus becomes somewhat D-shaped, the urethra is displaced anteriorly, and the perineum is frequently torn. The actual birth of the child usually takes two uterine contractions, *i.e.* the pain that results in the delivery of the head has gone off before the shoulders are born. The birth of the body of the child is associated with the escape of the hind-waters.

The cervix and lower uterine segment. In addition

to the changes already outlined, there are certain important occurrences which must be dealt with specially. The cervix is further back, and this is due to the over-anteflexion which occurs in the early months. The formation of the lower uterine segment has been much discussed for many years. Having considered various opinions and having observed many cases of labour, there seems to be little food for discussion. As already mentioned, the uterine muscle is divided into various layers (p. 39). The longitudinal fibres in the upper contractile portion have a very definite function to perform, the circular fibres in the cervix are also of importance. When labour starts, the drawing-up power of the longitudinal fibres in the upper segment gradually draws up the circular fibres in the lower segment; this in time *takes up* the whole cervix, and by the time this has occurred, the os is fully dilated and taken up. This phenomenon can sometimes be shown on abdominal palpation, when by a careful examination the retraction level may be demonstrated, and the length of this level from the pubes is often a fair indication of the size of the cervix, though it really only indicates the tension of the lower segment. The discussion as to the origin of the lower segment from the cervix or from the body is at the moment unproved. Various arguments have been advanced, but fortunately there is but little autopsy material to prove any contention. We believe that if the uterus is taken as consisting of (1) a hard, thick, upper contractile portion which surrounds the cavity, (2) a portion leading to the cervix, and (3) the cervix, the theories are best explained as follows. (*a*) If the internal os is taken as being at the beginning of the portion between the cavity and cervix, the lower segment is made up of both body and cervix; but (*b*) if the internal os is at the junction of body and cervix, the lower segment arises only from the cervix (see Fig. 45). Be the origin what it may, if the student bears in mind (*a*) contractions of the uterus pushing the presenting part downwards, (*b*) resistance being met, (*c*) a pull of the longitudinal fibres of the upper part of the uterus drawing the circular fibres of the lower segment upwards, (*d*) gradual obliteration of the cervix by this means, the comprehension of the lower segment becomes an easy matter. The junction

of the two segments is known as Bandl's ring, but the danger sign of a "standing out" of this ring as against a simple retraction level must be carefully diagnosed. Bandl's ring is a prominence when danger is present; the retraction level is only obtained after gentle and careful palpation.

A diagnosis between *contraction* and *retraction* must be made. A contraction is a *temporary* shortening of the uterine muscle fibres: if retraction did not occur in labour, no advance would occur, for with each contraction there would be a kind of rebound. Retraction takes place, whether there are contractions present or not, and is a

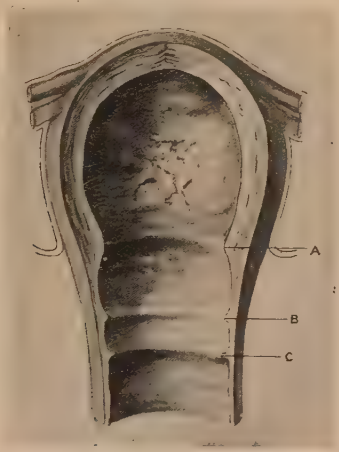

FIG. 45.—Diagram of Bandl's ring. Illustrating theories of formation of lower uterine segment. A, Bandl's ring; B, Internal os; C, External os.

permanent shortening as opposed to the temporary shortening of a contraction: in addition the fibres are thickened. *Dilatation* of the cervix occurs not only from the growth of the lower uterine segment as already pointed out, but by pressure either from the bag of membranes or from the pressure of the presenting part.

Before dealing any further with this subject, we must bear in mind the action of the liquor amnii, which has an all-important bearing on mechanism. In fact, on the presence or absence of the liquor amnii will depend to a large extent the prognosis; for so long as the foetus has got its protection, the danger of encroachment on the placental site, and subsequent interference with oxygen supply, is

avoided. Once the membranes rupture, this danger becomes very real. In addition, the action of the "bag of waters" in mechanically dilating the cervix must not be lost sight of. The liquor amnii is divided definitely into two parts, and the lower part (the fore-waters) becomes separated fairly early in labour and is the real hydrostatic dilator in front of the foetal pole. Once full dilatation of the os occurs, the membranes as a rule rupture. The presence or absence

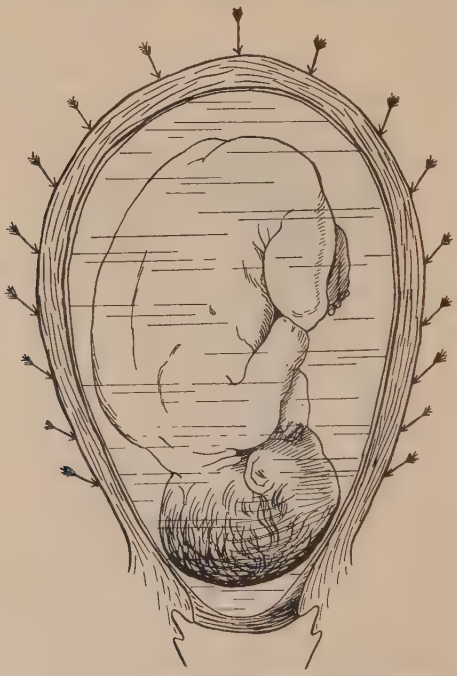

Fig. 46.—Indirect intrauterine pressure.

of this fluid has an important bearing on the "forces of labour." As long as the membranes are unruptured, the uterine contractions cannot act upon the foetus directly: they do act indirectly, however, and this action is directed equally on all portions of the foetus. This force is called variously *general contents* or *general indirect intrauterine pressure*. Fig. 46 illustrates how this action occurs. It will be easy to understand, with pressure directed in this way, that the possibility of extrusion of the ovum encased in its "bag of waters" may, and sometimes does, arise.

Once the *membranes* rupture, a new force comes into play, the back of the foetus is more straightened out, and a force is applied directly to it. Fig. 47 shows this force, which is applied chiefly from above down, and bears various names—*direct intrauterine pressure*, *foetal axis pressure*, and sometimes the almost peristaltic action from above downward is called Polarity of the Uterus. The longitudinal muscle fibres are said to be chiefly responsible for this pressure. Other names have been given to various forces, but they seem to us to be complicated and to confuse the issue.

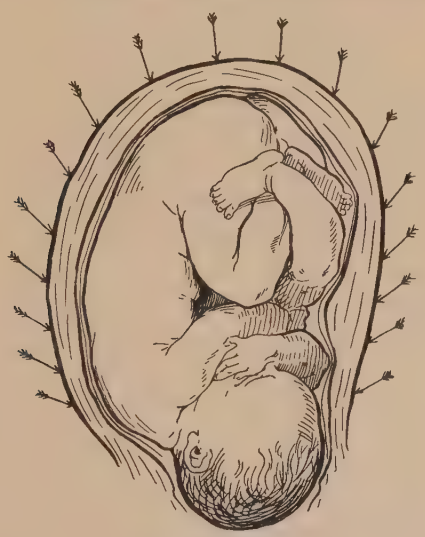

FIG. 47.—Direct intrauterine pressure. (Figure should show back slightly more extended.)

OTHER FORCES CONCERNED IN LABOUR

Before concluding this chapter, the pelvic floor must be mentioned, for, as will be shown later, this floor, as chiefly represented by the levator ani muscles, is of extreme importance in the mechanism of internal rotation. Full detail of the pelvic muscles is unnecessary in this work and can be found in anatomical text-books.

The Superficial Transverse Perineal Muscle rises from the ascending ramus of the ischium, and from the base of the triangular ligament, and is inserted into the central tendon of the perineum.

The Sphincter Vaginae, or **Bulbo-cavernosus Muscle,** arises from the central point of the perineum, and is inserted into the outer margin of the pubic ramus and into the dorsal surface of the clitoris.

The Deep Transverse Perineal Muscle arises from the pubic and ischiatic rami near their junction, and is inserted into (1) the part between the urethra and the vagina, and (2) the central tendon of the perineum.

The Sphincter Ani Externus arises from the tip of the coccyx, and is inserted into the central tendon of the perineum. The deep fibres encircle the anal canal.

The Levator Ani Muscle is the chief muscle of the pelvic floor, and consists of the following parts :—The *pubo-coccygeus* arises from the posterior part of the body of the pubis and from the fascia on the inner surface of the compressor urethrae. It passes backwards at the side of the vagina and rectum, and is inserted into the coccyx and into the median raphe between the coccyx and anus. It has also some insertion into the central tendon. It will be thus seen that this muscle has intimate relations with the vagina, bladder, urethra, and rectum, and therefore is an important factor in the support of these viscera. The *ilio-coccygeus* has but small importance, and is usually a thin sheet of muscle blended with the pubo-coccygeus, and stretching from the ilium to the coccyx. The *ischio-coccygeus* is often aponeurotic, and is not important. It stretches from the ischium to the sides of the coccyx and last piece of the sacrum.

The Pelvic Fascia. The term pelvic fascia is applied to the fibrous tissue found covering the muscles which line the side wall and form the floor of the pelvis, and also to certain layers and strands which pass inwards and invest the pelvic viscera.

The pelvic floor is pierced by the urethra, vagina, and rectum. The mechanism by which the pelvic floor acts is :—In dilation of the vagina, the anterior part of the floor is drawn forwards and upwards, while the posterior part is pushed downwards and backwards. The former is especially noticeable at Caesarean section, when the bladder is seen drawn up into the abdomen. The latter is important, as it

causes a large amount of soft tissues to lie below the pelvic outlet: in fact it causes an elongation of the soft parts of the pelvis as a continuation of the axis of the outlet.

THE MECHANISM OF LABOUR

In considering this important subject, depending on which a knowledge of midwifery rests to a large extent, it must be remarked that there are certain main factors to be thought of. In fact the method by which the baby is brought through the birth passages depends on (*a*) the soft parts, (*b*) the bony pelvis, (*c*) the baby.

The first has already been commented on, and we shall now deal with the others.

It is necessary to determine how much room there is for the foetus, and to consider carefully the diameters of the pelvis through which the foetus must travel.

In previous editions we dealt with the anatomy of the pelvis in an introduction to the book. We have come to the conclusion that it will be simpler for the student to understand mechanism if he has a full knowledge of the anatomy and diameters of the pelvis fresh in his memory.

The Pelvis is divided into (*a*) True Pelvis, (*b*) False Pelvis. These two are separated from each other by the ilio-pectineal lines, and in obstetrics we are chiefly concerned with the former.

The bones of which the pelvis is made up are—(1) the two innominate bones, (2) the sacrum, (3) the coccyx.

(1) **The Innominate.** This bone is formed by the fusion of the ischium, ilium, and pubis. This fusion does not take place until after puberty has been reached, a fact which is of some importance from an obstetrical point of view, since the pelvis will run the risk of distortion should the individual be subjected to any undue stress or strain during early life. It is in articulation with the sacrum at the sacro-iliac synchondrosis and with its fellow of the opposite side at the symphysis pubis. The anterior superior iliac spine and the crest of the ilium are points to be located in external pelvimetry, the normal distance between the two former being 26 centimetres, and the distance between the crests of the ilium 29 centimetres.

The other important points on the innominate bone are the posterior superior spines of the ilia, the distance between which is 9 centimetres, and the measurement of this gives a clue to the transverse diameter of the inlet.

On the ischium, the downward and forward curve may be of some slight importance in causing internal rotation. The ischiatic spines are important landmarks in many ways.

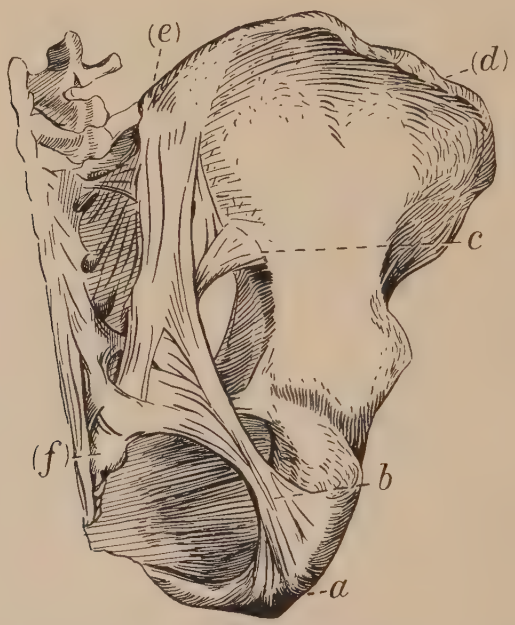

Fig. 48.—Figure to show certain points and ligaments (from Spalteholz). *a*, tuberosity of ischium; *b*, sacro-tuberous ligament; *c*, posterior inferior iliac spine; *d*, iliac crest; *e*, posterior superior iliac spine; *f*, coccyx.

They are used in determining the depth in the pelvis to which the presenting part has descended: their prominence or flatness will be a help in estimating the amount of room in the pelvis. The distance between the tuberosities of the ischium is 9 centimetres, and is the transverse diameter of the outlet.

(2) **The Sacrum** is triangular in shape and composed of five fused vertebrae. On each side the upper three or four vertebrae articulate with the ilium; during pregnancy there is some slight range of movement between these bones, while in

the normal unimpregnated condition practically no movement is possible.

The Ligaments of the pelvis, from an obstetrical point of view, are as follows.

The ligaments which attach the sacrum and lumbar vertebrae to the ilium are of importance in estimating the

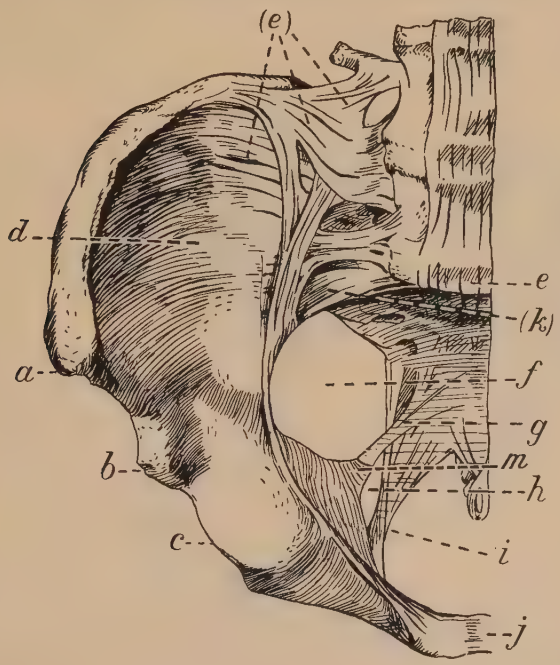

FIG. 49.—Figure to show certain points and ligaments (from Spalteholz). *a*, anterior superior iliac spine; *b*, anterior inferior iliac spine; *c*, ilio-pectineal eminence; *d*, iliac fossa; *e*, sacral promontory; *f*, great ischiatic foramen; *g*, sacro-spinous ligament; *h*, lesser ischiatic foramen; *i*, sacro-tuberous ligament; *j*, symphysis pubis; *k*, anterior sacro-iliac ligament; *l*, ilio-lumbar ligament; *m*, ischiatic spine.

angle between these bones in order to determine the curve of the pectineal line. They are well illustrated in the figure (48), as are the ilio-lumbar and anterior sacro-iliac. The subpubic ligament under the pubic arch has importance in the operation of symphysiotomy.

The sacro-spinous ligament, which stretches from the sacrum to the ischiatic spines, helps to form the great ischiatic foramen, while the sacro-tuberous ligament, which

goes to the tuberosity of the ischium (see Fig. 49), forms the lesser foramen.

The true pelvis is divided into (*a*) the brim, (*b*) the cavity, (*c*) the outlet.

The Brim, or bony boundary of the upper pelvic strait, stretches from the symphysis pubis round the ilio-pectineal line, past the sacral alae, to the promontory of the sacrum. The latter is a very important point, and consists of the

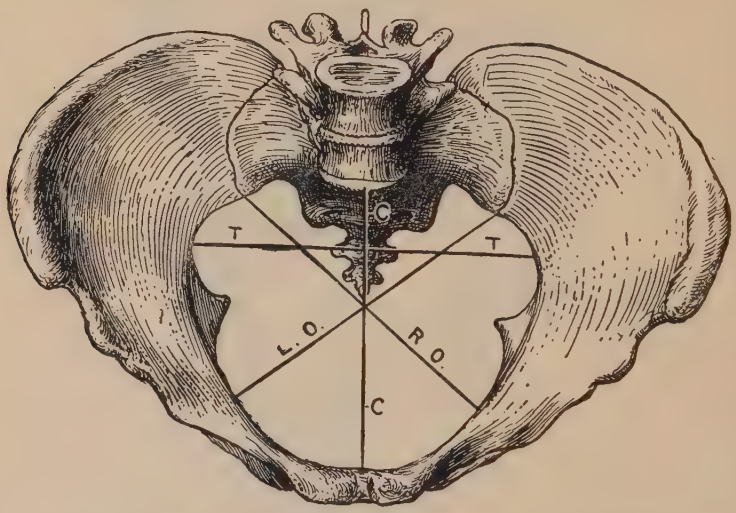

FIG. 50.—The pelvic inlet. T, transverse diameter: L.O. and R.O., left and right oblique diameters; C, true conjugate diameter.

intervertebral disc between the last lumbar and first sacral vertebrae.

From it is measured the **true conjugate**, conjugata vera, or antero-posterior diameter of the inlet. This extends from the promontory to the back of the top of the symphysis pubis, and measures 11 centimetres. Another conjugate, the **obstetrical conjugate**, extends from the promontory to the most prominent part of the back of the symphysis. The other diameters of the brim are the transverse and the obliques. The transverse diameter stretches between the widest part of the ilio-pectineal lines. It is not in truth a diameter, for it does not go through the centre of a circle (see Fig. 50), and measures 13 centimetres. The right oblique

diameter is measured from the right sacro-iliac synchondrosis to the left pectineal eminence, and the left from the left sacro-iliac synchondrosis. Each of these measures 13 centimetres. Roughly, then, the measurements of the inlet are—

True conjugate, 11 centimetres.
Transverse, 13 centimetres.
Obliques, 13 centimetres.

The brim is at a definite angle to the horizon owing to the articulation of the femur with the pelvis, and this can

Fig. 51.—Pelvic inclination.

be shown by placing a pelvis with femora attached on a table, when it is found that it has a definite inclination. This inclination is of importance, for any exaggeration may give a wrong idea, especially with regard to over-riding of the pubes. The pelvic inclination, which is the angle which the plane of the superior strait makes with the horizon, is about 60 degrees (see Fig. 51). The promontory of the sacrum is found to be from 9 to 10 centimetres above the symphysis when the woman stands up.

The axis of the brim is very important, and may be said to stretch from the umbilicus in the direction of the coccyx: this, then, is the direction in which traction is

made at first during delivery of, *e.g.*, a breech. It is marked in black in Fig. 52.

The lower strait corresponds to the pelvic outlet, and extends from the lower border of the symphysis in front, round by the ischial bones, to the coccyx behind.

The axis of the outlet is also of much importance, for a knowledge of it allows one to understand ordinary mechanism, and especially does it allow correct traction to be made through the outlet: its direction is from the promontory of the sacrum to the middle point of a line

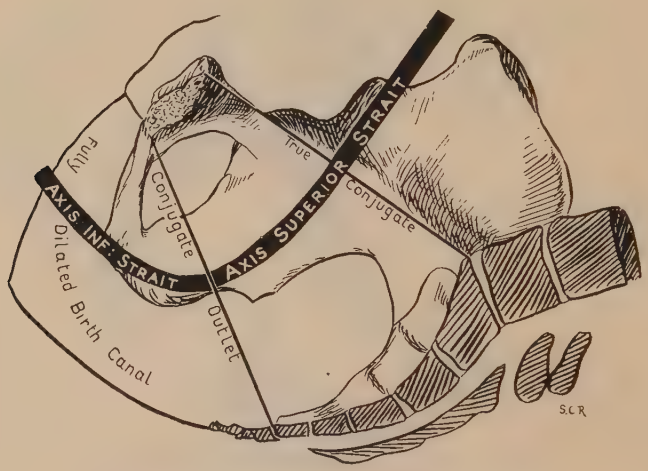

FIG. 52.—Pelvic axis.

joining the ischiatic spines (see Fig. 52). The relation of the perineal supports to this axis has already been mentioned (pp. 91, 96).

As the soft parts, which are chiefly represented by the psoas and obturator internus muscles in addition to the pelvic colon, lessen to some extent the upper strait, so the outlet is lessened to some extent by soft parts.

The pelvic outlet (see Fig. 53) has two diameters, the antero-posterior and the transverse. The former extends from the inferior margin of the symphysis to the coccyx, and the transverse extends from the inner margin of the tuberosities of the ischium.

Its anterior and lateral boundaries consist of the pubic arch and the great sacro-sciatic ligaments.

In considering the pelvic outlets at all, it must be remembered that in contraction of the outlet the pubic arch may be so narrow that the diameters are of little value, and the greatest value will be obtained by a measurement of the **posterior sagittal diameter.** This stretches from the last piece of the sacrum to the middle of a line joining the tuberosities of the ischia. It measures about 10 centimetres and is

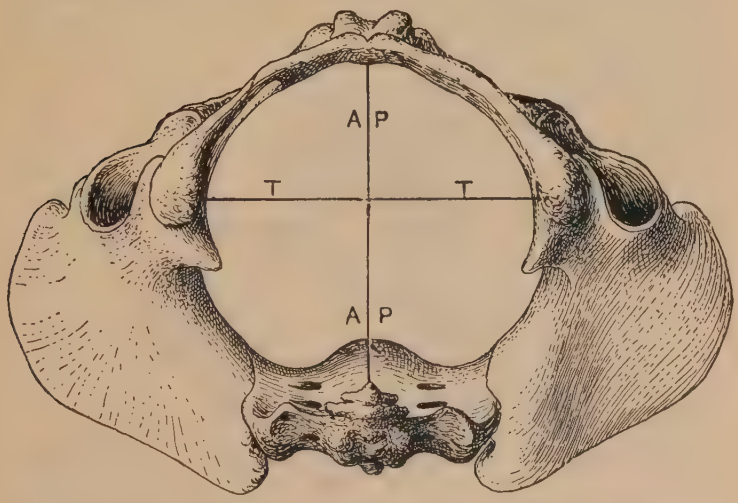

FIG. 53.—The pelvic outlet. T, transverse diameter; A.P., antero-posterior diameter.

measured from the last piece of the sacrum to a point just in front of the rectum (see Fig. 54).

The anterior sagittal diameter has very little importance: it stretches from the inferior end of the symphysis to the middle point of the line which joins the tuberosities of the ischia.

We have spoken of the upper and lower strait, and we must now speak of the **middle strait.** At this level in the pelvis the diameters *are at their greatest* (the plane of greatest pelvic dimensions). It is represented posteriorly by the bodies of the second and third sacral vertebrae, and anteriorly by the centre portion of the posterior surface of the symphysis pubis. Laterally it is bounded by the ischial bones in the

diameter which extends through the centre of the acetabula. The antero-posterior diameter measures 12·75 centimetres, the transverse 12·25 centimetres.

The plane of *least pelvic dimensions* extends from the lower border of the symphysis through the end part of the sacrum and the ischial spines. Its transverse diameter measures 10·5 centimetres and is from one ischial spine to the other.

Among other reasons for understanding these measurements, is the fact that the ischiatic spines are the points of importance in determining the level of a forceps application.

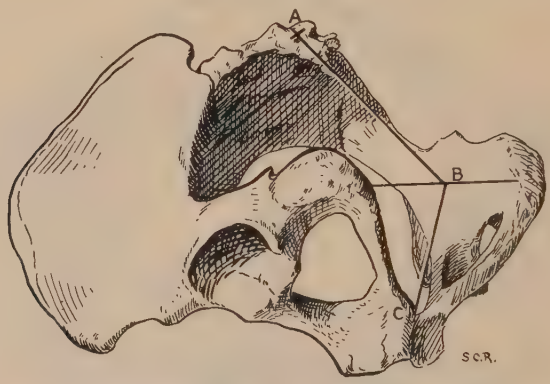

Fig. 54.—Sagittal diameters of pelvis. A to B. Posterior sagittal diameter. B to C. Anterior sagittal diameter.

It is necessary to remember that the anterior wall of the pelvic cavity is shorter than the posterior, the former being about 3·75 centimetres, the latter about 11·25 centimetres. As will be seen later, these account for asynclitism.

We have shown how the pelvis is made up, the amount of space in which the baby has to travel, and its direction. We shall now consider the diameters of the foetal head (the passenger) and compare them with the space in the pelvis (the passage).

To sum up diameters :

	Centimetres.		Centimetres.
Interspinous	26	Posterior sagittal	10
Intercristal	29	Anterior sagittal	5·5
External conjugate	20	Posterior interspinous	9
Inter-tuberous	9		

Measurements taken internally.

	Centimetres.
Antero-posterior	Inlet 11
Transverse	,, 13
Obliques	,, 13

The outlet measurements vary. The antero-posterior is of little importance and is about 13 centimetres, while the inter-tuberous has been given.

The Foetus. The skull is the most important part of the child's body to consider (see Figs. 55, 56).

Foetal skull. The vault of the skull consists of the parietal, occipital, and frontal bones, separated from each other by membranous sutures and spaces. The part of the skull which stretches from the glabella to the bregma is called the Sinciput; the portion between the anterior and posterior fontanelles is called the Vertex, and the remainder of the vault from the posterior fontanelle backwards, the Occiput. The spaces occur where three or more sutures meet, and are called fontanelles. The frontal suture separates the frontal bones. The coronal suture separates the frontal and parietal bones. The sagittal suture separates the parietal bones. The lambdoidal suture separates the occiput from the parietal bones.

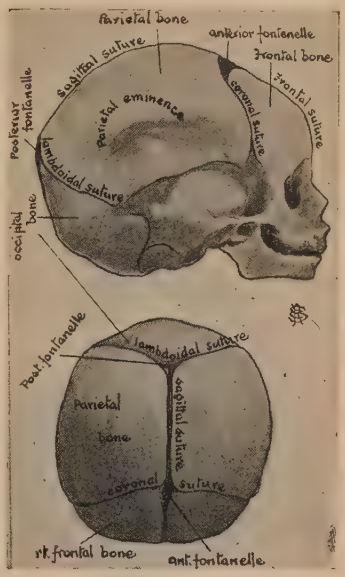

FIG. 55.—The foetal skull.

The anterior or large fontanelle or bregma is diamond-shaped, and is formed by the junction of the sagittal suture with the coronal sutures, that is, it is a diamond-shaped space consisting of unossified membrane with *four* sutures meeting in it. The posterior, or small fontanelle, is a triangular area, which consists really of a small gap between the edges of the two parietals and the occipital bones, and is the meeting-place of three sutures. These different points are important in making vaginal examinations, with a view to diagnosis.

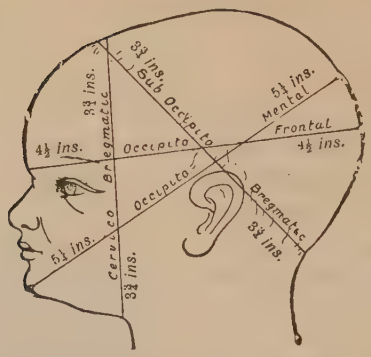

Fig. 56.—Diameters of the foetal head.
(The measurements in this figure are given in inches. Translation into centimetres is simple, 2½ cm. equal 1 inch, approximately.)

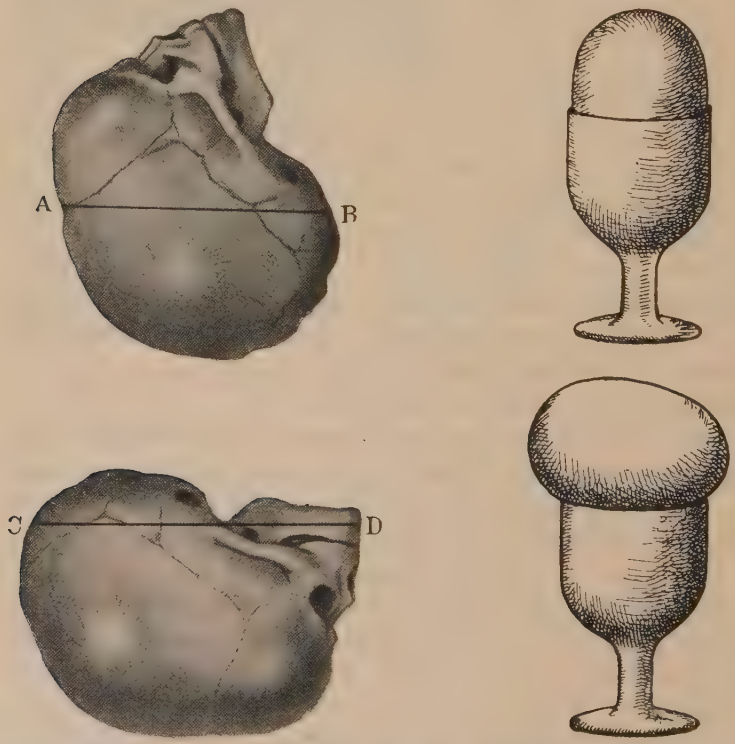

Fig. 57.—Diagrams showing egg-shape of the foetal head. A, B, Suboccipito-bregmatic diameter, which engages in vertex presentations. C, D, Occipito-mental diameter, which engages in brow presentations.

When the head is fully flexed, the suboccipito-bregmatic diameter, which is 9·5 cm., engages. In other words, the

largest section of the foetal head that has to pass, has for one diameter the suboccipito-bregmatic diameter, which is 9·5 cm., and for the other diameter the bi-parietal diameter, which is also 9·5 cm. When the head is less flexed, the suboccipito-frontal diameter, which is 10 cm., engages; still less flexed, the occipito-frontal 11·5 cm.; and neither flexed nor extended, the occipito-mental, which is 13 cm. When the head becomes fully extended, the cervico-bregmatic diameter passes, which measures 9·5 cm. To all these sections the bi-parietal diameter of 9·5 cm. is common. The difference between a flexed head and a head between flexion and extension, as regards the ease of fitting into the brim, is much like the difference of the fit of an egg into an egg-cup, according as it is put in in the ordinary way or across the egg-cup (see Fig. 57).

To sum up the foetal diameters, they are as follows:

Diameter.	Description.	Length (cm.).	Presentation.
Suboccipito-bregmatic	From just below the occipital protuberance to the centre of the bregma.	9·5	Vertex.
Cervico-bregmatic	From the junction of the neck and chin to the centre of the bregma.	9·5	Face.
Bi-parietal	From one parietal eminence to the other.	9·5	Face and Vertex.
Bi-temporal	From the anterior ends of the coronal suture.	8	Marked flexion.
Occipito-frontal	From the occipital protuberance to the root of the nose.	11·25	Engagement.
Suboccipito-frontal	From just below the occiput to the anterior end of the bregma.	10	Incomplete flexion.
Occipito-mental	From the occipital protuberance to the point of the chin.	13	Brow

These are the noteworthy pelvic skull measurements. Other measurements are those of the trunk, especially those engaged in breech presentations, which will be given later.

MOULDING AND CAPUT SUCCEDANEUM

Moulding. It has already been pointed out that the vault of the skull consists of several bones separated by membranous sutures and fontanelles. The process of labour

causes compression of these bones by the maternal parts. The alteration in shape of the skull which the fluid allows is called moulding. The moulding which occurs in the different presentations will be referred to in the chapters on presentations. The amount of moulding is very important and is an indication of the amount of pressure the skull has undergone: when physiological in character it is of great advantage, for it allows of an easier passage of the head through the pelvis. It is often an indication for delivery and sometimes serves as a warning that the foetus is not in a position to undergo further pressure: if pressure on the skull becomes too great cerebral haemorrhage will occur.

Caput Succedaneum. This is also a normal occurrence, and its position in the various presentations will be given as they arise. It is a swelling on the head caused by a collection of serous fluid into the subcutaneous tissues which arises from interference with the venous return. This swelling is found on the most dependent part of the head where there is no pressure, that is, pressure of the head by the pelvis (bones and soft parts) causes a swelling (caput) on that part which is free. When pronounced the caput succedaneum is an indication of extreme pressure and may be diagnostic of disproportion with danger to the child. The caput is not limited to any set of sutures, and this point serves to differentiate it from a cephalhaematoma.

What is learned from pelvic and foetal skull measurements. From these measurements it is evident that the longest diameter of the foetal skull will lie along one of the oblique diameters of a normal pelvis, for the oblique diameters are the largest diameters of the normal pelvic inlet. It is also evident that a fully flexed head has more chance of passing through the pelvic canal than has one that is less flexed. Thus, if it is a very tight squeeze for the head, the head will be fully flexed, and the presentation known as the posterior fontanelle will result. But the more roomy the pelvis, the less need is there for the foetal head to flex, and we have known a primigravida deliver herself of a full-term child, whose head was neither flexed nor extended (brow), fifteen minutes after the full dilatation

of the os. The question is therefore a relative one, but with an average pelvis and an average foetal head it is necessary that the latter should be sufficiently flexed to allow the suboccipito-bregmatic diameter of 9·5 cm., or suboccipito-frontal of 10 cm., to be the largest diameter to pass the inlet of the pelvis. Less flexion than this, resulting in either anterior fontanelle presentation (occipito-frontal diameter 11·25 cm.) or brow (occipito-mental diameter 13 cm.), as a rule leads to difficult labour, or the head fails

Fig. 58.—Impacted face. Showing impossibility of delivery with shoulders.

altogether to pass the pelvic inlet. Full extension, on the other hand, resulting in face presentations (cervico-bregmatic diameter 9·5 cm.), enables the head to pass readily through the normal pelvic inlet.

Looking again at the average measurements of the pelvic inlet and outlet, we see that in a normal case when the foetal head has passed the brim there is no narrowing of the pelvis, and therefore no reason why the head should not pass through the canal and pass the outlet. So, too, if a less flexed head passes the inlet without difficulty, it will as a rule be delivered without difficulty. Increased flexion may occur in the canal, but this only improves matters

and allows a smaller diameter to pass; or a brow may flex or extend, and this again makes the passage of the head easier.

When the face passes the brim the case is different. If the chin is in front against the pubes, the cervico-bregmatic diameter, 9·5 cm., is the largest to pass, and all goes well. But if the chin points backwards and remains directed backwards, the neck enters the pelvic cavity with the head, and further progress becomes impossible (Fig. 58).

Once again, by comparing these measurements we learn that the longest diameter of the head, which at the pelvic inlet lies in the oblique diameter, for this is the longest diameter of the brim, will, as it nears the outlet, tend to lie in the antero-posterior diameter, for this is the longest diameter of the outlet. Rotation of the head then takes place during its descent through the pelvic canal. It is, in fact, a definite rule of the mechanism of labour—*that the most advanced part of the foetus, as it descends, is turned to the front by the levator ani muscles and the other structures that form the pelvic floor.*

We have now considered (1) the bony pelvis, its axis, diameters, etc.; (2) the measurements of the foetus. We have also considered the changes in the uterus in labour, the formation of the lower uterine segment, the distribution of the soft parts. We must now take into account a general consideration of mechanism, paying special attention to the forces concerned in labour.

PRESENTATIONS AND MECHANISMS

GENERAL CONSIDERATION OF PRESENTATIONS AND MECHANISMS

In order to understand the treatment of abnormal presentations it is essential to be familiar with the mechanism of labour in normal presentations. The presentation gets its name from the part of the foetus which lies lowest in the parturient canal, the position from the relation which the back of the foetus bears to the abdomen of its mother. Normally the vertex, or the part of the child's head between the anterior and the posterior fontanelle, presents. In vertex presentations there are four normal positions.

Presentations (see Figs. 59–66). In Vertex I the occiput and back are in front and to the left (left occipito-anterior); in Vertex II the occiput and back are in front and to the right (right occipito-anterior); in Vertex III the

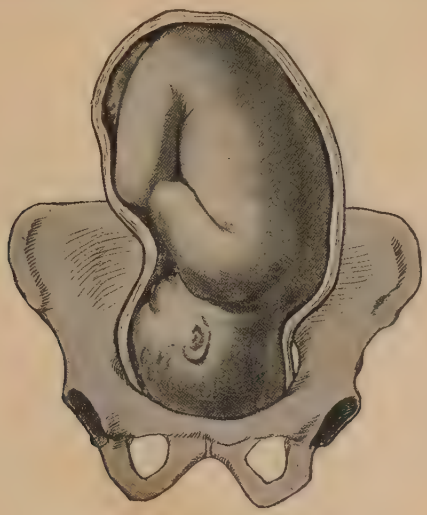

Fig. 59.—Vertex I.

occiput and back are behind and to the right (right occipito-posterior); and in Vertex IV behind and to the left (left occipito-posterior). The head, in fact, may swing round the

Fig. 60.—Vertex II.

circle of the pelvis, and the occiput may occupy any one of the four quadrants.

From these four vertex presentations the rest of the presentations may be deduced. Thus the four different

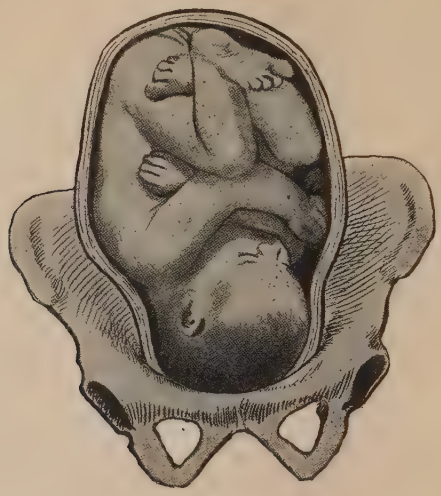

Fig. 61.—Vertex III.

positions of the brow are similar to those four vertex presentations, only the head is neither flexed nor extended, and the brow presents. The four face presentations are

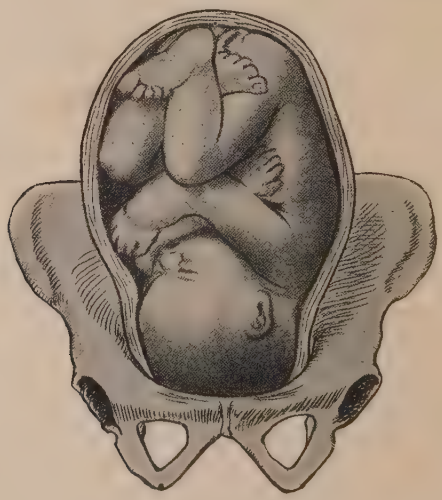

Fig. 62.—Vertex IV.

similar to the four vertex presentations, only that the head, instead of being flexed, is extended. The four transverse arise from the four vertex by pushing the head out of the pelvic brim into the corresponding iliac fossa or loin. Thus

Fig. 63.—Brow III.

in a first transverse the occiput and back are to the left and in front, but the head is not in the pelvic brim. The four breech presentations are similar to the vertex, only the

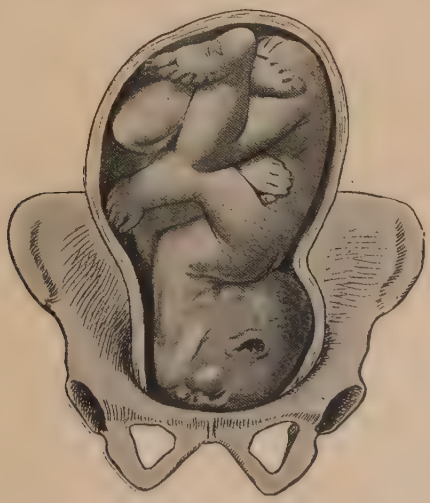

Fig. 64.—Face IV.

breech of the child presents instead of the head. Thus we have :

Vertex I. The vertex presents, the occiput and back are to the left and in front.

Vertex II. The vertex presents, the occiput and back are to the right and in front.

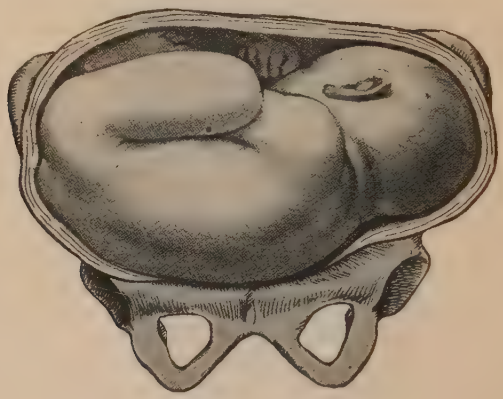

Fig. 65.—Transverse I.

Vertex III. The vertex presents, the occiput and back are to the right and behind.

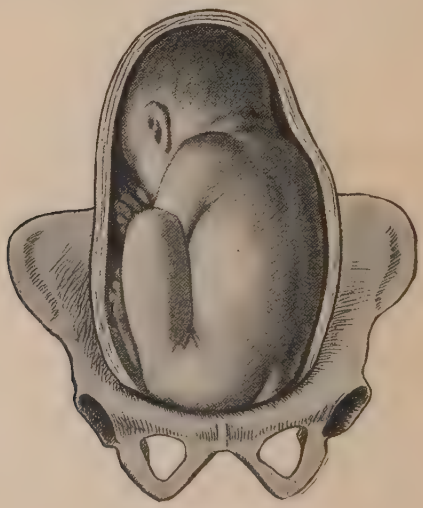

Fig. 66.—Breech I.

Vertex IV. The vertex presents, the occiput and back are to the left and behind.

Slightly extend the head: Vertex I becomes Brow I; Vertex II becomes Brow II; Vertex III becomes Brow III; Vertex IV becomes Brow IV.

Fully extend the head: Vertex I becomes Face I; Vertex II becomes Face II; Vertex III becomes Face III; Vertex IV becomes Face IV.

Push the head into the iliac fossa to which the occiput is directed: Vertex I becomes Transverse I; Vertex II becomes Transverse II; Vertex III becomes Transverse III; Vertex IV becomes Transverse IV.

Place the child with the breech downward: Vertex I becomes Breech I; Vertex II becomes Breech II; Vertex III becomes Breech III; Vertex IV becomes Breech IV.

It should be mentioned that many writers do not subscribe to this simple method of deducing positions from the normal. With them the chin in face presentations determines the position, therefore what we call a first face presentation they would call a third, and so on. With them also, in breech presentation the sacrum is the determining point, and the positions of breech are named left sacro-anterior, etc.

Mechanism. In a normal presentation the vertex presents, and the child's head is born with the occiput in front and the face towards the mother's sacrum. All other cases are abnormal and are not the result of chance. There is something abnormal in the conditions present. But they do not all need assistance; indeed, with the exception of transverse and probably brow presentations, all others may be delivered by the natural efforts within twenty-four hours.

What is meant by a normal pelvis and a normal foetal skull. We have already enumerated the average measurements of the pelvis and the skull, but there may be many departures from the normal.

It is difficult and well-nigh impossible to measure satisfactorily the foetal skull before birth, and while measurements are satisfactory in many ways, the real test of labour is the fitting of an individual skull to an individual pelvis, in other words, that *disproportion* should be absent. It is necessary to be acquainted with the average, and the

average or common mechanism is the normal. It is by a close study of the mechanism and progress of labour that good results in obstetrics can be obtained.

CONSIDERATION OF MECHANISM OF VERTEX PRESENTATIONS

In considering these, certain movements will be described suggesting that they occur separately: this is not so, for concerted action takes place in several instances. In addition the mechanism will be described as for a first vertex presentation (L.O.A.). From it the other mechanisms can easily be determined.

The several movements may be described shortly as:

1. Engagement.
2. Descent.
3. Flexion.
4. Internal Rotation.
5. Extension.
6. Restitution.
7. External Rotation.

Each of these will be dealt with separately.

Engagement. As has already been stated, the head fixes about three weeks before labour starts in a primigravida, so that unless the position of the head is studied before this, it is difficult to follow. When a multipara is examined, it will be found that the occipito-frontal diameter engages the right oblique diameter of the pelvis. This measures 13 centimetres, and is the largest diameter of the pelvis, for the size of the transverse is lessened by the promontory leaving only a diameter smaller than the oblique. The right is most usual, because there is less room in the left because of the rectum. Sometimes the engagement is *synclitic*, at other times *asynclitic*. When, however, the latter is marked, some abnormality must be looked for.

When synclitism is present, the sagittal suture is equidistant from the pubes and sacrum, and the difference in route of descent of the head as necessitated by the greater length of the sacrum than the pubes is known as synclitism.

Asynclitism is divided into Anterior and Posterior.

Anterior asynclitism is when the sagittal suture is

closer to the promontory and the anterior parietal bone is lowest (see Fig. 67).

Posterior asynclitism is when the sagittal suture is closer to the pubes and the posterior parietal bone is lowest (see Fig. 68).

The former is known also as Naegele's obliquity, having been first described by him.

The latter is known as Solayre's or Roederer's obliquity.

Descent. This goes on during a great part of the labour, and commences in the case of a multipara with engagement :

Fig. 67.—Anterior asynclitism.

it is chiefly noticeable during the second stage, in fact some authorities hold it only begins with the onset of the second stage. It is due, before the membranes rupture, to the indirect uterine pressure : following this, direct pressure, with some straightening of the foetal back, is the cause, and the abdominal muscles play their part in the movement. In describing synclitism, it has been already pointed out how part of this descent occurs.

Flexion (Fig. 69). This is merely an alteration in the attitude of the foetal head, and is an effort to replace the occipito-frontal by the suboccipito-bregmatic diameter, *i.e.* a diameter of 11·25 is replaced by one of 9·5 centimetres. This movement is caused by two main factors :

(1) The shape of the foetal head—more being anterior than posterior. This has often been described as the Lever theory, and is a question of pure mechanics, in which, when resistance is encountered, the head moves on the occipito-atlantal joint in such a way that the long arm of the lever ascends, and the short one descends.

(2) The fact that there is less resistance at the posterior portion of the head than at the anterior. This allows the

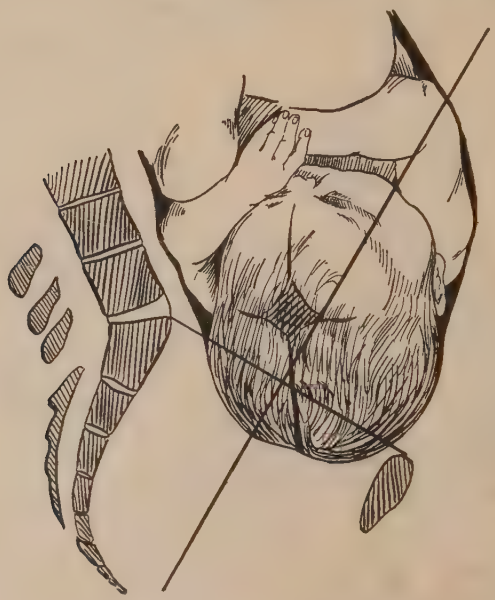

Fig. 68.—Posterior asynclitism.

smooth occiput to slip downwards past the resistance offered by the pelvis. Fig. 70 illustrates both of these theories.

Internal Rotation. This is the first real movement in mechanism as distinct from attitude. It is also probably the most important, and any malrotation is usually fraught with difficulty and danger. It brings the suboccipito-bregmatic diameter, which was in the right oblique diameter, into the antero-posterior diameter of the pelvis, and it occurs for certain definite reasons. There is a law that the part of the head which strikes the pelvic floor first must rotate to the front, and the reason for this is obvious: the pelvic

floor slopes downwards, forwards and inwards, therefore when flexion has brought the occiput lowest, it is obvious that, having struck the sloping pelvic floor (see Fig. 89), it must rotate to the front.

Therefore, to sum up the *causes* of internal rotation, they are : (1) Flexion which has brought the occiput lowest; (2) the occiput, being lowest, follows the laws of mechanics and rotates because of (3) the direction of the pelvic floor downwards and forwards.

It used to be thought that the direction of the ischium

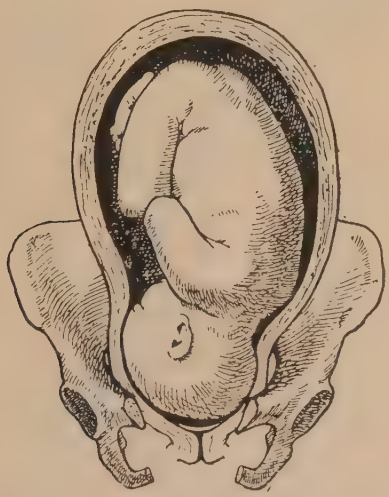

FIG. 69.—Flexed head engaged in the pelvic brim.

was responsible, but the experiment of pushing a head through a pelvis immediately after death, when rotation occurred, and later when the muscles had lost their tone, when no rotation occurred, proved to a sceptical world that the muscular pelvic floor and not the pelvic bone was the chief reason for the occurrence of internal rotation.

Extension. The occiput is now under the pubes. The only thing it can do is to go in the line of least resistance out through the vulva, so the movement of extension occurs because the head must follow the line of least resistance. Otherwise it would be directed towards the sacrum. There are three causes for this movement—(1) contractions of the uterus, (2) the curve of the pelvic floor, which points

forwards and upwards, and directs the head (3) in the line of least resistance. The head is then born by extension under the symphysis pubis. It is important that this movement should take place gently and gradually, to distend the perineum. This will be explained later, in the delivery of the head.

Restitution. When the head is born it is twisted in regard to the shoulders; and as a man who is crushed in a crowd in an uncomfortable position rights himself when the crowd moves on, so the head rights itself (restitution) in

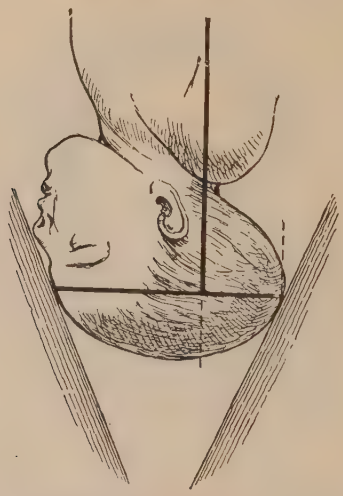

FIG. 70.—Diagram to illustrate cause of flexion of the head (due to the greater part of the head being anterior to the occipito-atlantal joint).

regard to the shoulders (bis-acromial diameter) when born. By careful observation of this movement the student will know which shoulder should be born first, *i.e.* the anterior, for in the L.O.A. and L.O.P. positions the occiput is turned slightly to the left of the mother, in R.O.A. and R.O.P. to the right.

External Rotation. The head rotates so that in the left lateral position the face looks towards the ceiling. This movement is caused by internal rotation of the shoulder, and this internal rotation occurs for the same reason that internal rotation of the head occurs. The right shoulder lies lowest and rotates forwards in the direction of the

anterior extremity of the antero-posterior diameter of the outlet—namely, under the symphysis.

Expulsion. This movement may occur very quickly. The anterior shoulder gets fixed under the pubes and is

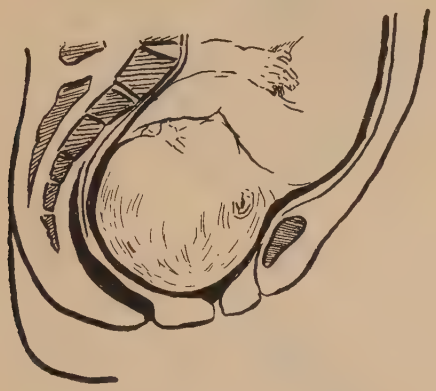

Fig. 71.—Flexion.

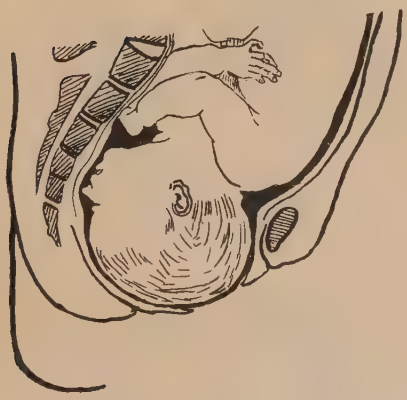

Fig. 72.—Internal rotation. Partial extension has occurred.

born: the posterior shoulder is born over the perineum and the body comes through the pelvis in the direction of the axis of the outlet by lateral flexion round the symphysis pubis without going through any very definite mechanism.

It must be remembered that the bitrochauteric diameter of the hips engages in the same diameter of the mother's pelvis as we have described for the bis-acromial diameter,

Fig. 73.—Extension.

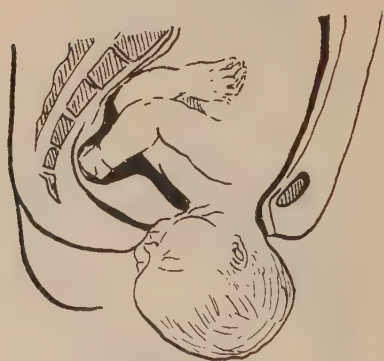

Fig. 74.—Restitution.

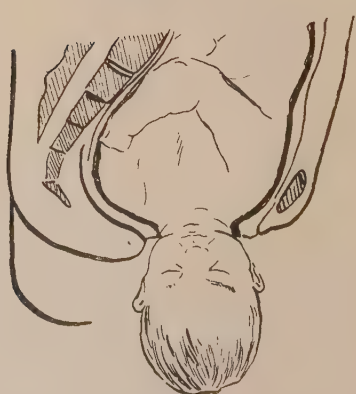

Fig. 75.—External rotation.

and that the hips also undergo internal rotation, viz. the right hip rotates from the anterior extremity of the left oblique diameter through one-eighth of a circle and lies under the symphysis at the anterior extremity of the antero-posterior diameter of the outlet.

The above is a simple description of mechanism in a normal first vertex presentation. By a thorough comprehension of this, all the other mechanisms will be easily followed and the abnormalities of labour will be understood.

CHAPTER VII

CONDUCT OF NORMAL LABOUR

THE student, having mastered the physiology of normal labour, can now proceed to its conduct with some degree of confidence.

THE MANAGEMENT OF A NORMAL CASE OF LABOUR

The necessity for surgical cleanliness. The cardinal rule for good midwifery is to be scrupulously clean.

We measure our success by the number of *morbid* patients we get. The number of deaths is not a good test, for deaths often occur as the result of complications and are not due to want of cleanliness. It is not until we compare the death-rate in thousands of cases that the superiority of the present-day methods over past methods is seen. That it is not fair to judge of success in midwifery only by the number of patients that die is well shown by the statistics of the Rotunda Hospital during 1766 and 1780. At that time there was no water supply to the hospital, but all the water was carried from a pump adjacent to the hospital cesspool. This cesspool leaked to such an extent that it was a cause of complaint by the neighbours, and the Master of the time, to the public authorities. The patients lay upon beds of straw. Two patients with their babies occupied each bed. Yet, in spite of these conditions, we read in the old reports, that in 1766 with 611 deliveries there were only three deaths, and in 1780 only five deaths out of 919 deliveries. Of course in other years the percentage mortality was far greater than it is now. The morbidity, that is, the rise of temperature, or temperature and pulse above normal, must have been far greater than at present. For instance, in 1878 clinical thermometers were introduced into the Rotunda Hospital. The Assistant Master of that time himself took the temperature of ninety-nine

patients during their stay of eight days in the hospital. His note-book shows that no less than 50 per cent. of these patients showed morbidity, nine had temperatures of 105° F., and eighteen temperatures of 103° F. They were not picked patients, and the Master reports the condition of the hospital at that date to have been "particularly healthy."

Our estimation is: if the temperature rises above 99° F. and the pulse rate above 90 per minute respectively on three consecutive occasions, counting from the beginning of the second day to the day of discharge, the patient is morbid. The temperature is taken by leaving a half-minute thermometer in the mouth for two minutes. The B.M.A. method of estimating morbidity is described on page 515.

It is interesting at this juncture to study the rates of morbidity.

From 1904–1905, 1,865 women were delivered, exclusive of abortions, in the Rotunda, with a morbidity, on the B.M.A. scale, of 8·77 per cent. From 1905–1906, 1,838 cases were delivered, with a morbidity of 8·43 per cent. From 1906–1907, 1,841 deliveries, with 6·41 per cent. morbidity; from 1907–1908, 2,020 deliveries, with 5·30 per cent. morbidity; from 1908–1909, 1,973 cases, with 3·70 per cent. morbidity; and from 1909–1910, 2,147 deliveries, with 4·33 per cent. morbidity. The mortality of these years was 0·31, 0·42, 0·38, 0·35, 0·20, and 0·18 respectively. (See Appendix.)

The great improvement shown by these figures over those recorded in 1878 is almost entirely due to the modern insistence upon surgical cleanliness in conducting midwifery.

In deciding on the best steps to attain cleanliness one must endeavour to formulate plans. The preparation of the room and of the bed is discussed later. With regard to the obstetrician himself, efforts have been made to convert an obstetrical case into an operation in a surgical theatre.

In some text-books the masked, gowned attendant is performing an operation, but is he looking after a normal confinement? We advocate sterile gowns when performing an actual operation. Unless the attendant has facilities for getting gowns sterilised, and unless he can convert the

room into a little theatre, a gown may prove to be a danger.

The untrained and unwary may, in his sterile gown, touch some portion of the room where the patient is lying—may consider his gown sterile, may allow his sterile gloves to touch the dirty gown, and then proceed with the delivery.

In other words, if the confinement room can be turned into a theatre, wear theatre equipment. If it cannot, the operator must keep his gloves clean, must touch nothing extraneous, and he will conduct his case with safety.

One other point must be discussed—shaving. The shaved patient is probably in a safer position than the unshaved, and we shave our patients. Some private patients object, and in that case, clipping of the pubic hair should be done.

At the beginning of labour in a primigravida, a purge may be administered, and an enema given later. The question of enemas requires great care and consideration, for the nurse must not give one if there is any chance of it coming back during the delivery. A good rule is—in a primigravida do not give an enema once the second stage has commenced; in a multipara an enema should not be given except at the commencement of labour.

The soaking of the vulva with bowel fluid may cause septicaemia.

The **bed** should be prepared while the patient is walking about.

It should be arranged in the following order from below upwards :

1. A hard mattress.
2. Large mackintosh to cover the whole mattress.
3. Blanket.
4. Sheet.
5. Mackintosh to cover three-quarters of the bed.
6. Draw-sheet.
7. Mackintosh over the draw-sheet, which hangs over the edge of the bed.
8. Draw-sheet or wood-wool sheet, which must be loose and not fastened by pins.

We used to leave the binder ready under the draw-sheet, but we have found this unsatisfactory, for it may get soiled,

and it is a simple matter to slip it under the patient. Any bedclothes which cover the patient before delivery must be pinned together.

Preparation of the room. When the patient is having her baby in her own house there are certain preparations to be carried through. We believe in having a room as free from heavy furniture, curtains, carpets, etc. as possible, but if these are to be moved, the removal should be done at least some weeks before the expected confinement. It is extremely dangerous to allow fresh dust to be scattered about when the labour is imminent.

Firstly, we must insist on a single bed. Boards should be provided to run between the mattress and the wire mattress, to simulate an operation couch. These boards can be made, or else leaves of a dining-table will be excellent substitutes.

Curtains should be removed—and the carpet if possible. Instead of the latter, a couple of rugs can be put down for warmth. Knick-knacks, such as photograph frames, etc. should be removed. The necessary basins, douche cans, etc. should be prepared. The bed should be placed so that when the patient is in position, she is in the proper light for delivery. There should be a chair for the accoucheur, at least three small solid tables on which to place instruments, basins, etc. It is convenient to have a small steriliser, and plenty of boiling water should be ready.

Diagnosis of presentation and position of the foetus. The secret of success in diagnosis is practice. Graduates and undergraduates delight in rushing to the labour wards to see difficult midwifery operations, most of which they will never have the necessity to perform, when their time could be much better employed in palpating every case which comes into the hospital. In the same way, students, qualified and unqualified, sometimes shirk the squalor of district work. It is here that the basis of sound knowledge of practical midwifery is gained, where diagnosis can be made *without* making an internal examination, and this is the keynote in success in obstetrics in after life.

In endeavouring to make a diagnosis of the presentation and position of the fœtus, a definite routine must be followed. By omitting certain parts of the ritual much valuable

information may be missed, and small points which will help the diagnosis will pass unnoticed.

The following is the routine which is taught at the Rotunda Hospital:

(1) Inspection of the abdomen.
(2) Palpation.
(3) Auscultation.
(4) External vaginal examination.

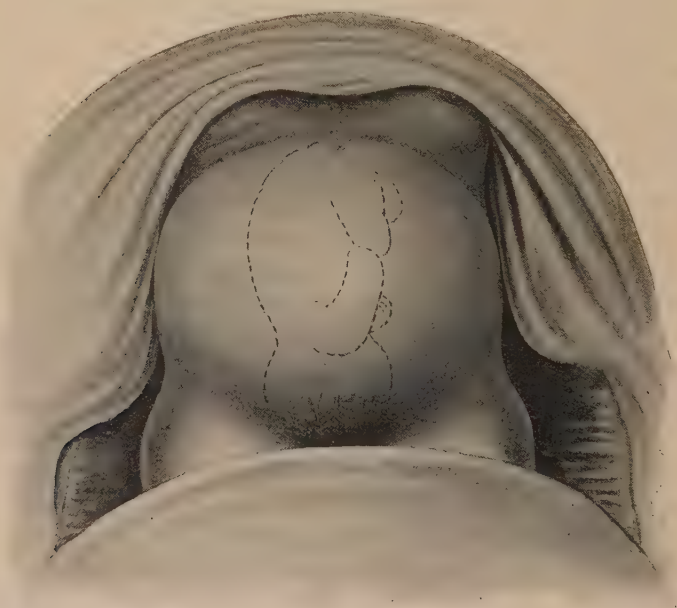

Fig. 76.—Vertex II as felt by abdominal palpation.

(5) Rectal examination (if necessary).
(6) Vaginal examination (if absolutely necessary).
(7) External measurements.

We shall now proceed to consider some of them.

1. **Inspection of the abdomen.** When we inspect the abdomen, the signs of pregnancy, linea nigra, lineae gravidarum, stretched umbilicus, are seen. Scars of previous operations are noted and inquired about.

Deviations from the normal shape of the uterus are marked: a transverse lie of the foetus must be especially thought of. Over-stretching of the abdomen, suggesting

the possibility of contracted pelvis, pendulous belly also, a uterus which appears too full, suggesting, *e.g.*, twins and hydramnios; convulsive movements of the foetus; too small pelvis,—a careful note of all these points is necessary. In fact inspection of the abdomen is an important asset in technique.

2. **Palpation.** We deprecate the custom which has crept into text-books of changing the old-time order of palpating the abdomen. There is no doubt that this is the

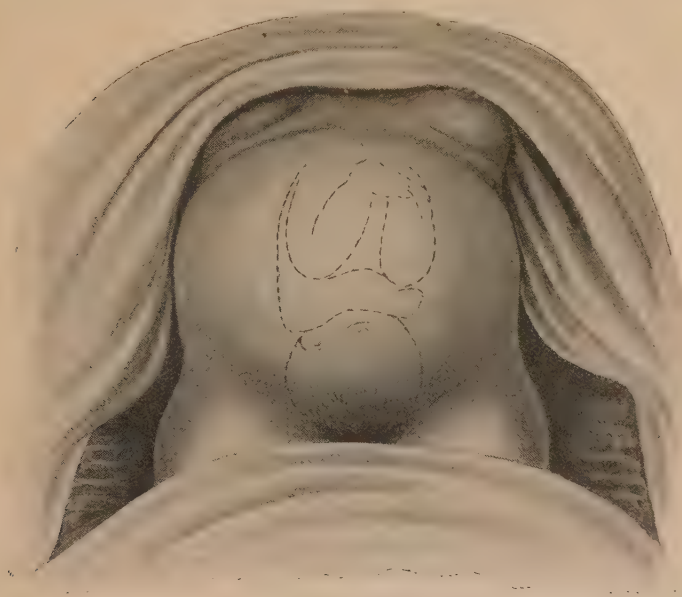

Fig. 77.—Vertex III as felt by abdominal palpation.

best method of diagnosis: there is no doubt that practice is required to become skilled in the art: there is also no doubt that the more practitioners become acquainted with it, the less will be the number of deaths from sepsis resulting from manipulation. In our own practice we *scarcely ever make a vaginal examination in a normal case*, and seldom in an abnormal one.

Palpation confirms what appears to be likely from inspection of the abdomen.

Technique of palpation. Place the patient on her back. Sit down on the right side facing her. Fold some

clothes over the chest, for this prevents her noticing the hands and takes away her attention from the examination. Try otherwise to distract her attention by conversing with her. The bladder must be empty. The method of palpation is divided into "grips," and we use the name still, but "grip" is not very applicable, for the only real grip is that of Pawlik. These grips are (1) Fundal, (2) Umbilical, (3) Pawlik's, (4) the deep pelvic grip. Remember that a

Fig. 78.—Palpation—fundal grip.

great help in diagnosis by palpation is to visualise a foetus in the abdomen.

The Fundal Grip. Sit facing the patient. Palpate between pains. Place the hands gently on either side of the fundus (see Fig. 78). In a normal case the breech of the child is at the fundus. It is recognised as the breech, because when it is moved the child's body moves with it, and because there is no groove of the neck that interrupts its continuity with the child's back. The knobs of the feet or knees in the lateral fundal parts may also be felt. They may be felt or seen to move, and the patient may feel a kick at the same time. Foetal movements indicate the position of the limbs. If, on the contrary, a head is present in the

fundus, there will be felt its excessive hardness, the groove of the neck, and the ease with which it can be moved independently of the body, the so-called "ballottement."

Umbilical Grip. The hands are now placed on each side of the umbilicus (see Fig. 79). On the left side in a first vertex will be felt the smooth resistance of the back, while on the opposite side will be felt the limbs. This is the true umbilical grip—pressing the foetus from one side to

Fig. 79.—Palpation—umbilical grip.

the other. This can be modified in one or two ways. The palm of one hand can be fitted over the fundus like a cap, and the breech pressed down. This causes the back to bulge forward a little, because the body bends, and the position of the back can be felt by dipping the fingers in passing from one side of the uterus to the other. Another modification of the umbilical grip is to press the tips of the fingers of both hands into the side of the uterus, to decide on the relative position of back and limbs.

When the back is behind and the limbs are in front, the latter are felt easily, and the fingers, instead of meeting the resisting back, dip into the hollow made by the flexed body.

Pawlik's Grip (see Fig. 80). There is rather a tendency to make this grip before the foregoing, but it is better to follow the routine suggested. It can be made by using the hand in the grip that would be used in seizing a man by the throat, or else it may be done with the thumb on one side and the first or second or both of these fingers at the other side of the presenting part. The head is seized in this way, but although the eventual grip is a firm one, the pressure must be gradual or the patient will resist. If, when the head is held in this manner, it cannot be moved from side

FIG. 80.—Pawlik's grip. Take great care to palpate the presenting part and not the pubis.

to side in the absence of a contraction, it is fixed, and this fixing is a sign of labour in multiparae; but it occurs about three weeks or more before full term in primigravidae if the pelvis, the presentation, and position are normal. Pawlik's grip gives further information. The child's head is flexed, as it passes through the pelvic brim into the pelvic cavity. The result of this flexion is that the occiput can no longer be felt, while a point in the neighbourhood of the brow is palpable on the opposite side. Before flexion has occurred the chin may be palpated.

If the examiner flex his own head he will feel it, and he will see that this is so. Thus Pawlik's grip reveals the degree of

flexion of the child's head, and so confirms the diagnosis of the position. Also it tells how much of the head is above the pelvic brim and has not entered the pelvic cavity. If the whole head has entered the pelvic cavity, the fingers dip into the groove formed by the neck, and thus, by Pawlik's grip, it might be thought that there was no presenting part. If so, then use the fourth, or pelvic, grip.

Deep Pelvic Grip. In this grip the attendant should stand with his back to the patient's head (see Fig. 81).

FIG. 81.—Deep pelvic palpation. Take great care to palpate the presenting part and not the pubis.

This grip is useful for determining the progress of the head. It also reveals the fact that there *is* a presenting part deep down in the pelvis. It allows the head to be felt until it is nearly on the perineum. The relation of the occiput to the chin can be compared by it.

Other abdominal methods of diagnosis. (*a*) A swift tap with the points of the fingers on the fundus may be of assistance in diagnosing a head from a breech presentation, for the comparative hardness of the former will aid.

(*b*) *The level of retraction.* This method has some value in diagnosis. It is done by sliding the fingers of one hand from above downwards from the umbilicus to the pubis.

The retraction level having been reached, the distance from the pubes to it is an indication of the size of the taking up and size of the cervix. This gives a fairly correct idea in about 50 per cent. of normal cases and is worth consideration (see Fig. 82).

Auscultation. We now use a modification of De Lee's stethoscope (see Fig. 83) for listening to the foetal heart. Our modification consists chiefly of the fact that the end-piece is movable and can be adapted to the slope of the abdomen.

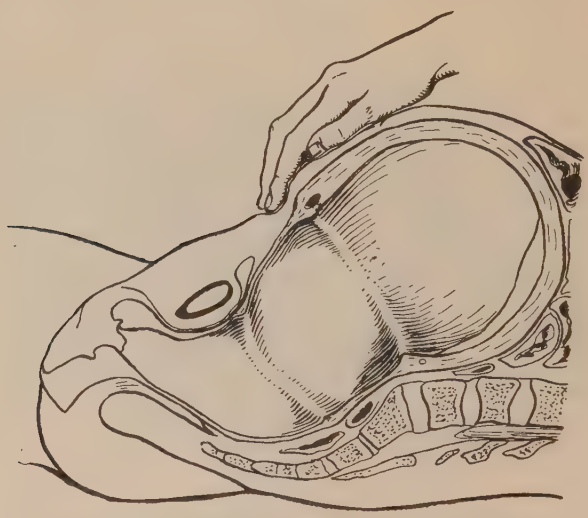

Fig. 82.—Diagram to show level of retraction.

If a De Lee's stethoscope is not to hand, an ordinary stethoscope or phonendoscope may be used, or else some people prefer to put the ear on a towel and listen directly for the foetal heart. The foetal heart in vertex cases is best heard on the side of the back, below the umbilicus. It is like a watch ticking under a pillow; the normal rate is between 120 and 160 except during a pain, when the rate may slow down to 80 beats per minute. Not only should the rate be counted, but the regularity and consistence should be noted. In breech presentation the foetal heart is heard just at or above the umbilicus. Fig. 84 demonstrates where the heart is best heard in some of the chief presentations: the others will be dealt with as they arise.

The heart should be heard in every case when the baby is alive: if it cannot be heard and counted by a skilled observer, it is dead.

It has been suggested that very early pregnancy can be diagnosed by means of a vaginal stethoscope. We do not believe that a potentially septic proceeding like this is worth the additional information which may be got.

Rectal examination. This method of examination has obtained increased popularity in many places. We believe it has value, but when practised it must be done with care,

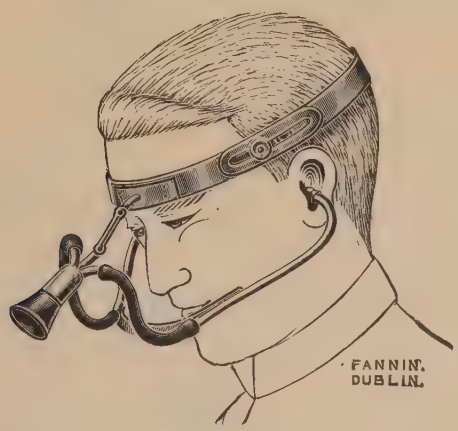

Fig. 83.—Solomons' modification of De Lee's stethoscope.

bearing in mind the possibility of injuring the rectum and of causing infection.

It is extremely useful and gives additional information in cases where the presenting part is very low down in the pelvis, and in long labours where vaginal examinations will be necessary, but where too many will be disastrous. In fact it is of value where further information is sought than can be got by palpation, and in order to avoid vaginal examination. We now practise this method of diagnosis to a greater extent than formerly, and value it, but we prefer to follow the course of labour in most instances by observation of its character, by palpation, and *external* vaginal examination. It is of inestimable value in a "test of labour." The size of the cervix can be estimated in many cases, but when in doubt, vaginal examination is a necessity.

When a rectal examination is made, different finger-stalls must be worn from those which are used in making a vaginal examination. The stall should be lubricated with soap or a little vaseline, and the finger pushed gently up the bowel. The examination should *not* be made immediately after an enema has been given, and in all cases the anus must be swabbed from before backwards, before the examination and after it is finished, to avoid contamination of the vagina with faeces.

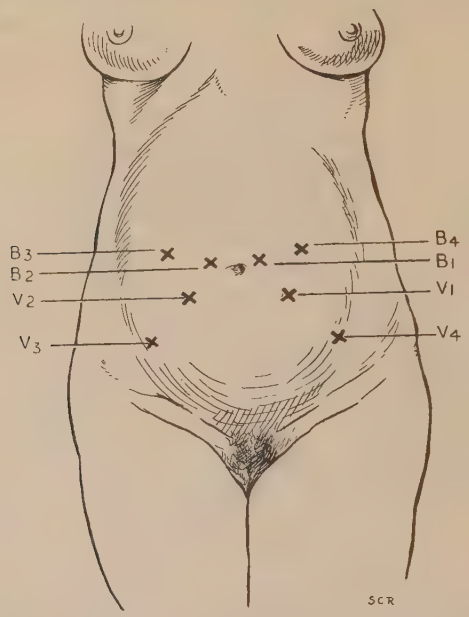

Fig. 84.—The position of the foetal heart in various presentations. V, vertex; B, breech.

External vaginal examination. We regard this as a more useful aid than the last type of examination. It can be used to follow the descent of the presenting part: the finger may not feel it at first, but on pushing down the foetus from the abdomen it will impinge on the finger placed as illustrated *between the anus and the coccyx* (see Fig. 85).

It will also tell the exact position of the part if palpation has not revealed it in the abdomen. It is absolutely without danger, and it is without discomfort when carefully and gently done.

Vaginal examination. We have already stated that a vaginal examination is but seldom necessary. There are, however, some occasions when it is urgent.

Indications for making vaginal examinations.

(1) If the accoucheur is not satisfied with his diagnosis by palpation and other methods, or considers it necessary to confirm it.

(2) In contracted pelvis (*a*) sometimes to ascertain the descent of the presenting part; (*b*) when the membranes

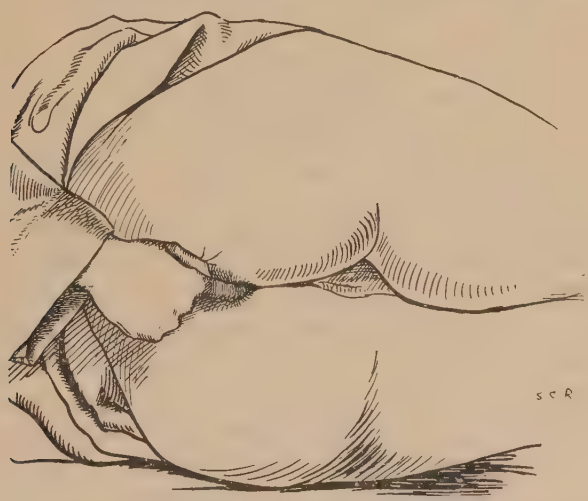

FIG. 85.—External vaginal examination or perineal palpation between the anus and coccyx.

rupture, to diagnose if the cord has come down; (*c*) to find the configuration of the pelvis itself, *e.g.* concavity of the sacrum, sub-pubic angle, the presence of rickety exostoses, proximity of the promontory, relation of cervix to head, presentation of the membranes or even of the cord.

(3) In cases of haemorrhage, to diagnose (*a*) if due to placenta praevia or accidental haemorrhage, (*b*) in the early months to find out the size of the os, extra-uterine pregnancy, etc.

Preparations for making and how to make a vaginal examination. Three basins are needed; these are scrubbed inside and out by the nurse, and boiled before

the doctor comes. The jugs must be equally clean. One basin is for soap and water, the second for plain water in which to rinse the hands, and the third for mercuric iodide solution (1–1000). Boil a nail-brush and a pair of rubber gloves in a bag for five minutes in a saucepan on the fire,

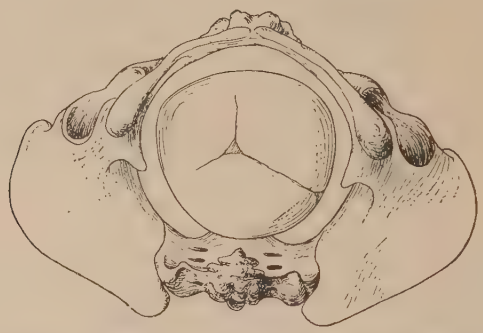

Fig. 86.—Vertex II as felt by vaginal examination.

then upset the gloves and brush from the bag into the basin containing mercuric iodide. Scrub the hands with soap and water for three to five minutes, occasionally changing the water. It is most important that the brush should be boiled, for, according to bacteriological research, an unboiled

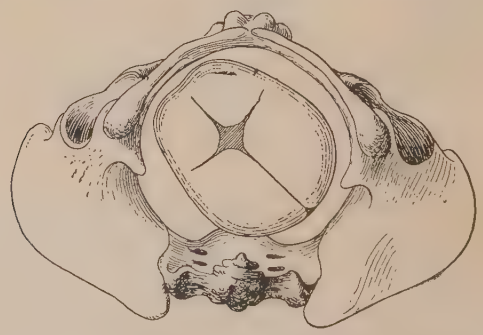

Fig. 87.—Vertex IV as felt by vaginal examination.

brush is often more dangerous than no brush at all. Pay especial attention to the nails and the spaces between the fingers. Rinse away the soap in the basin of clean water, for soap destroys the action of mercury salts. Soak the hands for one minute in the solution of biniodide of mercury. Put on a glove, which slips on easily when well filled with

water. All preparations for examinations should be preceded by the removal of the coat and the rolling up of shirt-sleeves. The rationale depends on the fact that septic organisms do not penetrate the skin and are easily washed off with soap and water. If the hand is moist and soft, or if it has been subjected to prolonged contact with septic material, the dangerous organisms may sink so deeply into the skin that they cannot be removed with soap and water. The second procedure, immersion in mercuric biniodide, will kill some bacteria and diminish the toxicity of others; it will also destroy many skin staphylococci which cannot be removed from the skin with soap and water. The immersion in mercuric biniodide will only deal with bacteria on the surface, as the biniodide has no penetrative power: the water causes softening and swelling of this surface epithelium, which becomes easily removed, leaving active the deeper bacteria. For this reason it is advisable to immerse the hands in methylated spirit so as to harden the aseptic surface layer. They are therefore placed in a solution of 1 part mercuric biniodide, 700 parts methylated spirits, 300 parts water. This has been found in practice to be a perfect skin antiseptic. Painting the abdomen with picric acid solution has the same object in view. No chemical as yet invented will prevent the skin softening under prolonged moisture, and this is one of the chief reasons for protecting the skin by gloves.

Lift up the right labium majus with a piece of cotton wool soaked in the biniodide solution. The muco-cutaneous surfaces of the labia minora, which guard the entrance to the vagina, are now exposed. On these surfaces septic organisms are found, therefore they require careful cleansing. Wipe them from before backwards with pledgets of sterile wool which have been soaking for ten minutes in a small dish of mercuric biniodide (1–1000), and lay a piece of wool soaked in biniodide solution between the labia for a few seconds.

What to feel at a normal case. It will be found that the vagina is freely lubricated, and if labour has started the secretion is blood-stained owing to the slight bleeding caused by separation of the membranes that covered the

internal os. This is the "show." Feel if the rectum is empty. Then feel for the os. The opened os in a primigravida is a circular opening with its edge flattened out on the advancing part. The opened os in a multipara has a short canal in early labour. Figs. 41, 42, 43 demonstrate this. The reason is, that the internal os opens before the external in the primigravida, but not in a multipara, for the connective tissue that closed the external os has been torn in the first labour. Indeed, in a multipara a finger can frequently be passed into the cervical canal in the later months of pregnancy, although the internal os is closed. If the internal os is opened in a primigravida so as to allow one finger to touch the bag of membranes and the head, and there is no hydramnios, labour almost certainly has begun. In a multipara, labour has very probably but not necessarily begun. At the same time feel the presenting part. In a normal case it is the head, and it can be felt easily, for the head is engaged in the lower uterine segment. Feeling a suture or fontanelle makes the diagnosis certain. For practice feel a suture on a new-born baby's head. Sometimes the breech feels as hard as the head, but there are no sutures.

Try to make out the lie of the child by vaginal examination, though it is better to do this by abdominal palpation. The posterior fontanelle, the point where three sutures meet, is the guide to the lie. It is forward and to the left in Vertex I, forward and to the right in Vertex II, posterior and to the right in Vertex III, posterior and to the left in Vertex IV. But this discovery of the lie by vaginal examination is not important, nor is it easy through a small os. Find out if the membranes have ruptured. It is not always easy to feel them, unless there is a pain. The utmost gentleness is necessary to prevent premature rupture of the membranes. When there is a pain the contracting uterus presses on the liquor amnii, and the membranes bulge like a convex watch-glass. Therefore, rub the uterus up with the left hand to make it contract. Finally, make an estimate of the size of the os if it is open. If the os is fully dilated, the head down on the perineum, and the membranes unruptured, scratch through the latter

with a boiled catheter stylet or with the finger. It is well to wait until there is a pain, when the membranes bulge and they can be easily ruptured. In the absence of a stylet a hairpin may be available for rupturing the membranes. It should be straightened, placed in the fire until red hot, and then kept in the antiseptic solution until needed. Injuries to the child's head and to the cervix have occurred through clumsiness and carelessness in rupturing the membranes. The os is opened fully when its edge cannot be felt at all, anteriorly or posteriorly. It is completely drawn up over the presenting part. It has been learnt, then, from the vaginal examination, if the head is presenting, if the membranes are unruptured, if the os is open, and its size, if it is open, also if there is prolapse of the cord. Its size gives a clue to the degree of advance of the first stage, for THE FIRST STAGE OF LABOUR LASTS FROM THE INITIAL OPENING OF THE CLOSED OS TO ITS FULL DILATATION. When the os is fully dilated it retracts above the head and can no longer be felt.

How to know that the Patient is in Labour.

(1) **The Show.** This is a blood-stained mucous discharge, which occurs nearly always in primigravidae, and sometimes in multiparae. When a patient has pains and a show, it is nearly certain she is in labour. Its absence does not prove she is not in labour. It is due probably to rupture of fibres in the lower segment, combined with some separation of the membranes. It must be diagnosed from the *operculum* (see p. 39), a plug of mucus already mentioned: this is usually only mucus. Occasionally the show is excessive, when it may be confounded with ante-partum haemorrhage. If there is any doubt, steps should be taken to diagnose if the latter is present.

(2) **The Pains.** The contractions of the uterus are painful, and the pains start low down in the back and shoot round to the front, sometimes going down the legs. The curve of a pain is interesting, showing a slow upward curve, with a very short acme. The pains are quite outside the will of the patient except in the second stage, when the voluntary efforts at bearing down help. Psychologically

speaking there is some effect, and we have noticed often that the presence of the doctor in the room may drive away pains which return on his departure. The interval between pains varies from half an hour at the beginning of labour to two minutes at the end. The average duration is about a minute.

During pregnancy, as already stated, the uterus contracts intermittently and painlessly: when labour sets in the patient becomes aware of these. The transition may be gradual or abrupt. It is usually gradual, and preceded by vague pains in the abdomen.

To detect whether the contractions are painful, if the patient is not in bed, ask her to go to bed. Then palpate the uterus, and note when it hardens. Ask her to say when she feels the pains, but do not ask a leading question when the uterus is hard. If the uterus hardens and she has a pain in her back at the same time, she is, almost certainly, in labour.

These *true pains* must be differentiated from *false pains*. The latter are very common, and are due to flatulence, medicine, colic, etc. When a woman comes near term she may think she is in labour. On careful examination it is found that the signs of true pains are present.

It should be noted carefully that the above constitute *true labour pains*, and these must be divided into first stage and second stage pains.

First stage pains are slight, occur at long intervals, and are unaccompanied by bearing down. *Second stage pains* occur more quickly, are more severe in character, usually happen after the membranes rupture, and are accompanied by voluntary bearing-down efforts.

(3) **The Fixing of the Head.** This only applies to multiparae, for, as already stated, the head fixes three weeks before labour starts in a primigravida.

In a multipara the head fixes in the lower segment between the pains: this tells us that the patient is in labour. On the other hand, the converse is not true, for in abnormal cases the head may not fix, although the patient is in labour. By "fixing of the head" is meant that by Pawlik's grip the head cannot be moved from side to side, or can be moved

just a trifle (p. 132). The reason is, that the lower uterine segment is firmly contracted round the head, and keeps it steady. The head, by "engaging" in the brim, reaches the lower part of the lower uterine segment, which lies a little below the level of the brim. If the head can be freely moved, and the contractions are not painful, the patient is not in labour.

(4) **The Dilatation of the Internal Os.** In a primigravida the internal os opens before the external os, *i.e.* the taking up of the cervix can be felt (see p. 90). In a multipara this sign is of very little value: the external os opens practically synchronously with the internal os, and the multipara's external os may be somewhat open.

By these four signs, therefore, it will be possible to determine that the patient is in labour. One of them alone may decide the diagnosis, but all four being present means certainty.

The Nurse. A nurse can be a blessing or a curse: she can assist in getting the patient well, or she may drive her to an asylum. A nurse must remember that in order that a case may be successful, she, the doctor, and patient must work together. Any friction will cause disaster. She must secure the confidence of her patient, and having secured it, must not abuse it. Having learnt her work at a maternity hospital, she must keep up the standard in her private practice. Too many nurses get slack in their methods, are slipshod, and in consequence the patient suffers. She must not praise a doctor other than the attendant. It is disloyal, and may make the patient dissatisfied. The doctor should secure a nurse on whom he can rely. If the patient is very desirous to have her own nurse, he must see her in order to find out if she is thoroughly trained, especially that she does not make vaginal examinations.

We have already shown the importance of cleanliness in the conduct of labour, and a vaginal examination made without the vulva or the fingers being properly cleansed is fraught with danger. Septic organisms do not and cannot live in the normal vagina. But they do live on the vulva, and they live on the fingers. Thus a careless vaginal examination is likely to push dangerous germs into the

cervical canal, which is naturally free of them. The danger is comparable with putting a dirty finger into the peritoneum. Therefore tell the nurse not to make vaginal examinations. We never permit her to make vaginal examinations. We ask her, if she is a stranger, how she is accustomed to wash the patient, to attend to the baby, and tell her how we like things done.

We then give the patient the following list of things to get :

Two mackintosh sheets for the bed, a yard and a half by a yard.

Twelve large wood-wool sanitary towels.

Three ounces of chloroform. It is well to take chloroform and ether as well.

Two large wood-wool sheets.

Fifty soloids of biniodide of mercury.

Four ounces of lysol or cyllin.

Gamgee tissue and absorbent cotton-wool.

Four binders. A binder should be a yard and a quarter long and half a yard wide, made of strong roller-towel material. Some women often prefer the ready-made binders with straps and buckles, obtained from surgical instrument makers.

In addition, the nurse should instruct the patient about baby clothes.

When the nurse should send for the doctor in a normal case. This depends very much on the doctor and the distance he lives from the patient.

On the following lines we are conducting a case where the doctor lives ten or fifteen minutes from the patient or the home.

1. **In the case of a primigravida.** If the patient falls into labour in the early hours of the morning, the nurse should give her morphine gr. $\frac{1}{4}$, which should have been left with her by the doctor : she will sleep until the morning, when the nurse should send a note saying exactly what has happened in the night and how the patient is progressing. The doctor should go and visit the patient, palpate her and give his orders. He should be sent for—

(*a*) If the membranes rupture. The nurse should send if

the presenting part is unfixed: otherwise there is no need to send when the membranes rupture, unless other signs are present.

(*b*) When the second stage has begun. The chief reason for coming at this point is to give the patient whiffs of chloroform: there is no need to be present for any other reason: it will be too early for delivery, and from this point of view, attendance when the head can be felt easily by pressure between the anus and the coccyx will be sufficient.

The nurse should be able to tell second stage pains by their character (see p. 142). There is *no need* to make vaginal examinations to diagnose that the patient is in the second stage of labour.

Sometimes in anxious cases the doctor remains in the house. If so, he should wait downstairs until the second stage has begun, else the patient may begin worrying for chloroform, and chloroform is bad for a patient in the first stage, for it tends to lessen the pains.

If the patient falls into labour during the day, the doctor should go and see her, and again before bed-time, after which the labour is conducted as above.

2. **In the case of a multipara.** The time taken can be gauged to a certain extent by the previous labour or labours; generally speaking, a woman who has been twenty-four hours over her first labour will be twelve over the second, the number of hours gradually diminishing with each successive labour. The orders to the nurse are the same as for primigravidae, except that the doctor should be sent for when the patient has good strong first-stage labour pains.

THE STAGES OF LABOUR

Labour is divided into three stages. The *first* is the stage of Dilatation. It begins with the onset of true labour pains, and ends with the full dilatation of the os.

The *second* is the stage of Expulsion, and starts with the full dilatation of the os, and ends with the birth of the child.

The *third* stage extends from the birth of the child to the expulsion of the placenta.

The first stage of labour.

Its management. The patient must be informed that this is the stage of dilatation; that though she feels but little onset, yet every pain means progress. In a normal case she should walk about, busy herself with her household duties: if there is anything abnormal, she should be kept in bed to avoid rupture of the membranes. The bladder and rectum should be attended to. Light nourishing food is taken. Purges and enemas are administered as already described.

The nurse prepares everything ready for the labour, including necessities for the baby.

This stage of labour is the longest, and occupies about twelve to twenty-four hours in a primigravida, and one to twelve hours in a multipara.

The patient now passes into the second stage of labour, and, as already stated, the diagnosis of the change can be made by the change in the nature of the pains: if a vaginal examination is made, it will be found that the os is fully dilated: but it should be unnecessary.

If the nurse has not already seen that everything is prepared, she should do so now. Everything must be ready for a douche—especially plenty of hot water. The douche bag is carried ready boiled, so that it need only be taken out of its case when needed. The rubber gloves should be kept either in a small bag (dry sterilised) or they should be placed in the biniodide of mercury solution. Ligatures should be ready for the cord, likewise a catheter and a mucus catheter. Instead of ligatures, artery forceps may be used as a preliminary. Small pledgets of cotton wool should be ready for the baby's eyes. Chloroform or ether should be in readiness with a mask. The hypodermic syringes should be tested to make sure they are in working order.

It is now known where everything is, so that if an emergency arises, it will be possible to set to work coolly and deliberately, without confusion. But it is well to set about these preparations quietly, for a clatter of instruments is apt to frighten patients.

As labour progresses, the position for the actual confinement must be considered, and boards must be placed under the mattress.

When the confinement is imminent, the **position for the second stage** must be considered.

The left lateral position is the common one. It leads to less exposure and is warmer than the position on the back. It is easier to attend a woman single-handed when she lies in the left lateral position. It is necessary to see that the nightdress is tucked up well away from the buttocks. If this precaution is not taken, the nightdress will certainly be soiled, and changing it will unnecessarily disturb the patient. If the second stage is tedious, she may lie on her back, for, as Smellie says, "in this position the weight of the waters, and, after the membranes are broken, that of the child's head will gravitate downwards, and assist in opening the parts, while the contracting force of the abdominal muscles and uterus is more free, strong, and equal in this than in any other attitude."

How to make the patient bear down effectively. If the patient does not want chloroform, the child will be born much more quickly if she bears down properly during the second stage, but we recommend all our patients to have an anaesthetic.

To make her bear down, put her on her left side. Tie a roller towel to the end of the bed. Put a foot cushion or stool against the end of the bed, against which she can put her feet when she has a pain and down the side of which she can put her legs when she has no pain, and thus avoid cramp. When she has a pain, she flexes her legs and puts her feet against the cushion. She pulls on the roller towel and keeps her mouth closed. Press her back, for this will give her something to strain against. She thus gets far better power to bear down than if she is left to herself. Assistance may also be given by pressing on the fundus during a pain, after the membranes have ruptured, but sometimes this is too painful. Occasionally, however, pressure on the fundus will save the necessity of forceps.

We have now described a typical second stage until the head is on the perineum.

Before the perineal stage is reached, anaesthesia has been given, the bladder has been kept empty, and an enema has been given. The progress of the head is watched by palpa-

tion and external vaginal examination chiefly, aided possibly by vaginal examination. When the head is on the perineum the patient is turned on her left side and effort is made to save it. The technique which we advocate at the Rotunda is as follows :

How to save the perineum. Our method at the Rotunda Hospital is based on the following principle. The flexed head is pushed by the uterus down to the perineum (see Fig. 88). Between the pains the levatores ani (see Fig. 89) cause it to recede. But when it has been pushed down until the occiput is under the pubic arch, the levators

Fig. 88.—Diagram of the head on the perineum.

thrust the head forward and it is delivered by extension. By maintaining flexion until the occiput has passed out under the symphysis, the smallest available diameter passes through the vulvar orifice. To obtain this result proceed as follows :

Stand facing the patient's feet. Pass the left hand between the thighs in front. The right is held free. Both hands are gloved. The thighs must not be widely separated, for this stretches the perineum. Place the fingers of the left hand on the foetal head and press it against the pubes, at the same time preserving its flexion until the occiput has passed the symphysis. A ready way of ascertaining this is the ability to feel the anterior part of the anterior fontanelle.

When this is felt, the heel of the right hand on a pledget of cotton wool soaked in antiseptic between the anus and the coccyx presses forward the head at the time when there is no pain (see Fig. 90); this causes extension, and the head is quietly expressed. In other words, the accoucheur may, so to speak, be one-handed until the anterior part of the anterior fontanelle is felt, when the other hand comes into play and pushes the *chin* forward.

So much for our method; yet, in spite of its adoption in the hospital, 45 per cent. of our primigravidae get torn perineums, to a greater or less extent, and have to be stitched. Most

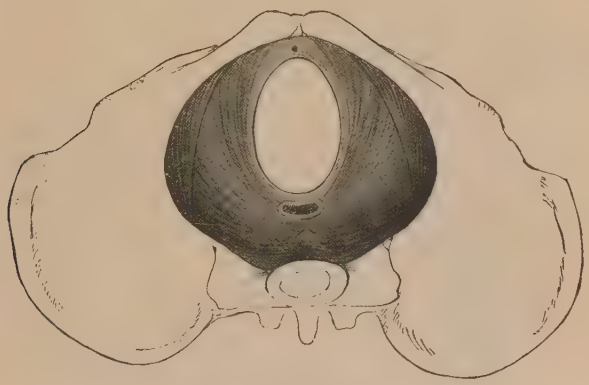

Fig. 89.—The pelvic floor from above.

of these patients are, however, attended by students and probationers without much experience.

We do not recommend direct pressure on the perineum. Episiotomy is not practised as a routine but is useful in inevitable tears, especially when a tear of the anterior vaginal wall is obvious. That is, if there is some haemorrhage in the neighbourhood of the urethra showing anterior tears, do episiotomy. It is a good manoeuvre but should only be practised when absolutely necessary. If there is an inevitable tear into the rectum, a lateral episiotomy should be done: in the type of case already described, a central incision is correct.

If it appears that the laceration will be very ragged, cut the perineum.

There are cases of rigid perineum where episiotomy must

be done, for otherwise there may be dangerous delay in the second stage.

Importance of attempting to save the perineum and recognising even small tears. Apart from sepsis, an unmended or undiscovered tear of the perineum is one of the greatest harms that can happen to a woman who has a normal childbirth.

The child's head is driven down by the abdominal muscles and the uterus. It is directed forward through the vulvar

Fig. 90.—Delivery of the head.

orifice by the levatores ani. The levator ani is a muscle which pushes the pelvic organs upwards and forwards. It runs obliquely across the pelvis and slings up the pelvic organs with the help of the pelvic fascia. If the levator ani and pelvic fascia are ruptured, this sling or floor of the pelvic organs is weakened, and, owing to the upright position of the female, descent and prolapse of the vagina are very likely to follow gradually. It is a curious fact that vaginal prolapse is more frequently seen in conjunction with the shorter tears ($\frac{1}{2}$–1 in.) than in those where a central perineal slit involves the rectum, the reason being that the levator

muscles are divided at their tendinous insertions in a central tear while the muscle fibres themselves escape laceration. Gynaecologists and obstetricians are nowadays agreed upon the necessity of suturing every tear of the perineum, other than laceration of the mucous membrane of the fourchette.

It is seen that to some extent the uterus and levatores ani antagonise each other. The uterus pushes the head downward; the levators push it upward and forward. The action of the levators can readily be seen in the receding

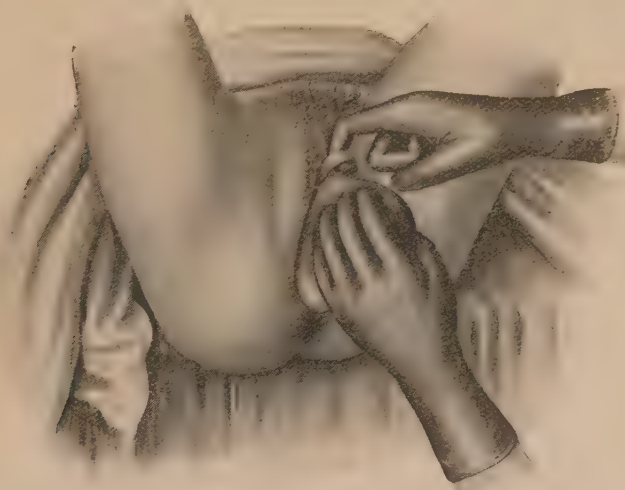

Fig. 91.—Pulling down a loop of cord that is round the baby's neck.

of the head from the vulva, when the uterine contraction has passed off.

The levators, stretched to their utmost, are sometimes torn from their attachments to the perineum. Such a catastrophe may leave the skin and superficial fascia intact, so that, at this stage, no lesion is apparent, but the intimate connection between the muscle and mucous membrane usually causes both structures to give way together, and tearing on the mucous surface is almost invariably followed by a slight flow of blood. This blood is often confused with the "show," but it should be looked upon as a certain indication, not that the perineum will tear, but that it has already torn.

The thinly stretched-out perineal skin, deprived of its underlying supports, rarely escapes uninjured. The extent of the laceration is never apparent until after delivery, and careful inspection of the perineum must never be omitted. A neglected tear may lead to cystocele, rectocele, retroversion, and all their attendant evils.

In addition, where the head has been a very long time on the perineum, a clean-cut surface may unite better than a hypertrophied one.

When the head is born. First see if the cord is round the child's neck. Do not push two fingers into the vagina,

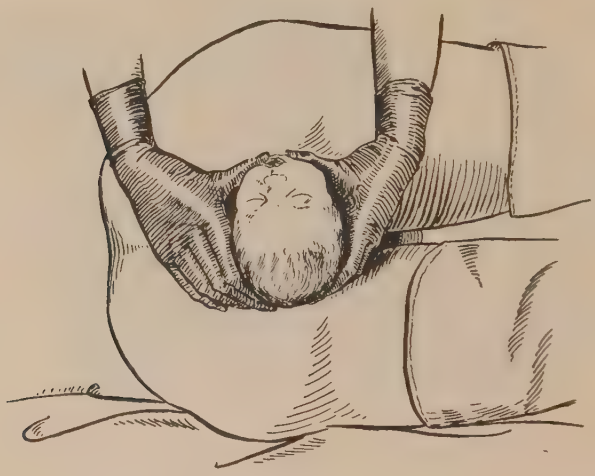

Fig. 92.—Delivery of shoulders. First step.

but pull the child's head towards the coccyx, which makes touching the vulva unnecessary. If the cord is round the neck it will be visible. Pull down a loop of it and pass it over the head (see Fig. 91). If the shoulders are being born, it can be slipped over the shoulders. If it is too tight to do this, cut the cord with scissors and deliver the child quickly. This proceeding is rarely necessary. A cord so tightly pressed upon will not bleed whilst the child is being delivered.

Care of mouth and eyes. There may be much mucus in the mouth of a child; its first breath is inspiratory, and it may choke itself. Therefore wipe out the mouth with

a piece of soft linen, or pledgets of damp cotton-wool, when the head is born. With similar pledgets of cotton-wool carefully wipe the eyes from the outer canthus inwards.

Birth of the shoulders and remainder of body. The birth of the shoulders is brought about naturally by the pain that succeeds that which pushed out the child's head. It is quite safe to wait for this pain, unless the face gets very blue, or twitches convulsively. The placental circulation

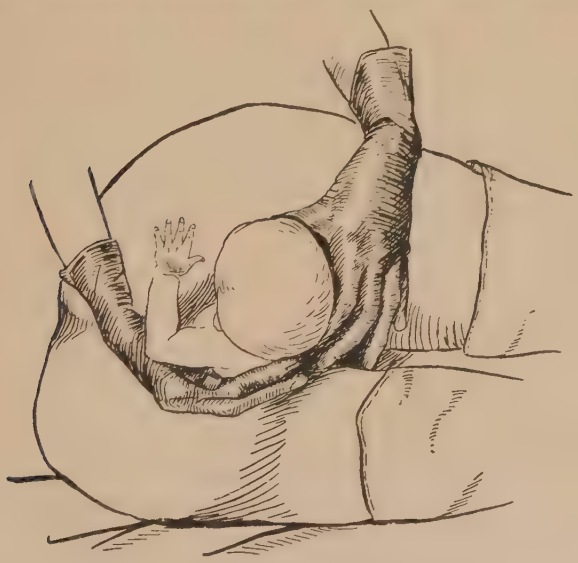

Fig. 93.—Delivery of shoulders and body.

has not stopped, and the child also often takes short breaths. If the head gets very blue, rub up the uterus to a contraction and deliver the shoulders by pressure on the fundus. Should this be unsuccessful, with the thumb of each hand under the chin, and the first two fingers of each hand under the occiput, draw the anterior shoulder downwards so that it will be delivered first, then draw the head upwards so that the posterior shoulder is delivered (see Fig. 92), after which the posterior hand of the accoucheur is slipped under the back to support it, while the fingers of the anterior hand remain grasping the occiput and chin (see Fig. 93). No harm can result from this manoeuvre, the normal mechanism is

followed, and unless undue force is exercised, traction on the head will yield no ill result.

Immediately the child is born, and if the patient is still under chloroform, examine the perineum with a view to stitching it if necessary : if she is not under chloroform, the perineum should not be stitched until the third stage is ended.

Anaesthetics in labour. These may be divided as follows :

(1) By mouth. Various drugs can be given as analgesics by the mouth, *e.g.* Veronal, Aspirin, Chloral, Bromide, etc. These can be given in early labour to quiet the patient, and their number is legion. The ordinary "three-fifteens" of most hospital formularies is satisfactory, containing 15 grains of chloral hydrate, 15 grs. of ammonium bromide, and 15 minims of tincture of opium.

(2) By injection.

(3) By rectum.

(4) By inhalation.

(5) Intraspinal.

(*a*) Intrasacral.

(*b*) Intrathecal.

(6) Hypnotism.

Morphine alone. Generally speaking, before the membranes rupture, morphine may be given without ill effect. To tide a patient over a tedious night, a quarter of a grain is a safe dose. After the membranes rupture it may be used, and its indication and contraindication are described in the chapter on inertia.

Twilight sleep. We have had a long experience of this method, and are not so enthusiastic as in previous publications. The method has achieved some ill repute through its use by unskilled obstetricians. When used with care, skill, and caution, no ill results will follow, but if used without due regard to the actual obstetric problem, disasters will follow. In a paper written in 1911, Freeland and Solomons gave the results of their investigations over a period of three years. Among their conclusions were—(1) it could be given by the mouth; (2) there is no need to keep the patient in a darkened room : in fact it is undesir-

able, for a patient under twilight sleep must be watched like a case under general anaesthesia; (3) no ill effects should follow for mother or child if a rational technique with careful observation is followed.

In spite of this, many observers report asphyxiated babies —some dangerously "blue." This, of course, is frightening, but after a short time the baby recovers. This recovery is brought about by allowing the babies to come to of themselves. No active attempts at stimulus should be practised.

On the rare occasions it is given at the Rotunda nowadays the following technique is followed:

First dose when the patient absolutely complains of pain. Morphine gr. $\frac{1}{4}$, scopolamine hydrobromide gr. $\frac{1}{100}$: when the effect of this begins to wear off, scopolamine gr. $\frac{1}{200}$; the third and fourth doses are gr. $\frac{1}{300}$ and gr. $\frac{1}{450}$, and are given when the pains recur.

If the labour continues after this, a dose of morphine gr. $\frac{1}{6}$ with scopolamine gr. $\frac{1}{300}$ is administered. If the labour has not terminated, the subsequent doses of scopolamine vary with the intensity of the pains and with the foetal heart rate; *e.g.* if the pains are very severe, from gr. $\frac{1}{100}$ to gr. $\frac{1}{200}$ is given, provided the foetal heart rate is normal.

The amount of scopolamine necessary varies enormously, and it is impossible to lay down definite laws beyond those already given.

Occasionally the patient gets very hysterical, and must be carefully watched for fear she should, for example, try to jump out of a window. The nurse must see that her jaw does not drop forward or that she does not swallow her tongue: for the same reason she should be kept lying on her side.

Omnopon can be substituted with safety and effect for morphine.

Before leaving the subject of anaesthesia by injection we must mention the hypodermic injection of novocain 2 per cent. into the perineum; this certainly lessens the pains at the end, but we are satisfied that chloroform is a better procedure, and requires less manipulation.

Rectal anaesthesia. We use this method on occasion

at the Rotunda: the modified Guathmey technique is carried out as follows:

The case must be absolutely normal, *i.e.* there must be no disproportion, malpresentation, etc.

In the case of a primigravida, when regular first stage pains are present, the os being the size of half-a-crown by rectal examination, while a multipara must be in definite labour.

The following then are the steps:

(1) A soap-and-water enema.

(2) Morphine gr. $\frac{1}{4}$ with 2 cubic centimetres of 50 per cent. magnesium sulphate intramuscularly. The ears are plugged and the room is darkened.

(3) Twenty minutes later the dose of magnesium sulphate is repeated *whether the pain has been lessened or not.*

(4) The first rectal injection of ether is given—

(*a*) If there is no relief from the morphine and magnesium sulphate.

(*b*) If the pains return, *i.e.* the effect of the previous drugs is wearing off.

Usually the ether is not required until at least one hour after the morphine and magnesium sulphate.

Within a quarter of an hour from the time of the first dose of rectal ether, a third intramuscular injection of magnesium sulphate is given. If subsequent rectal instillations of ether are necessary, magnesium sulphate is also repeated immediately afterwards.

The effect of the rectal ether lasts for two or three hours, during which time the patient is in a state of light ether anaesthesia (flushed face, dilated pupil, ether in breath, etc.).

This method of anaesthesia may last for upwards of 24 hours: it seems to prolong labour for a few hours; pains continue regularly and there do not appear to be any deleterious effects.

The *ether mixture* is as follows:—

Quinine alkaloid	grs. xx.
Alcohol	♏ xv.
Ether	ʒij ss.
Olive oil	ad. ʒiv.

The first instillation contains quinine grs. xx; in subsequent instillations there are only grs. x.

Technique of preparation and administration. Having removed the cork from the bottle, warm the ether mixture; also warm two ounces of olive oil separately. Put the patient in the left lateral position and place vaseline thickly around the anus. Introduce one ounce of olive oil by gravity from a tube and funnel. Run in the ether mixture. Finish with another ounce of warm olive oil. The tube is removed very slowly and pressure on the anus is exerted for about 15 minutes: the patient is also instructed not to force downwards. She is under the influence of the anaesthetic in about 15 minutes.

Fig. 94.—Nickel chloroform bottle.

By inhalation.

(*a*) Nitrous oxide. This method has been used very largely in other countries, but has not been taken up here, chiefly because of the expense. It has the advantage that it is safe, but it requires the constant care of the accoucheur or of a skilled anaesthetist.

(*b*) Chloroform and ether. It is well to discuss these two together.

Chloroform is the anaesthetic most used in labour. It is believed by some to be entirely safe at this time, but there is no doubt that while it is safer in labour than at any other time, it is by no means entirely safe.

In order that the greatest amount of safety should be obtained, a warning must be made that it should be kept in a dark place. We always keep our chloroform in a nickel drop bottle (see Fig. 94), and our store in hospital either in a dark cupboard or in its original bottle, covered with a green cloth.

Contraindications to chloroform. Any patient suffering from toxaemia or from haemorrhage should not be given chloroform. The changes in the liver and other organs are the same in toxaemia as in chloroform, and the latter

diminishes the CO_2 combining power of the blood. As haemorrhage may be a toxaemic symptom, ether is substituted for chloroform in these cases. In spite of other opinions, we prefer ether to chloroform in such conditions as heart and kidney disease : also in exophthalmic goitre. If chloroform has been given, adrenaline should not be administered at the same time, because of its cardiac effect.

How to administer chloroform. In a normal case we use an ordinary Schimmelbusch frame and give the patient a few drops when she has a pain. During the delivery the nurse continues the dropping : she should be instructed to keep the stain the size of a shilling and not to keep the mask tightly on the face, that is, she should give the patient plenty of air. The patient should be in a good light, so that she can be seen.

When chloroform is given for forceps or other delivery, and there is no other medical man, start the anaesthetic and get the patient nearly under, then wash up and proceed with the operation, letting the nurse follow the same routine as in a normal case.

There is no doubt that chloroform delays labour—it may cause a dangerous delay when given before the second stage has well started. It causes definite delay at any time.

The breathing should be watched carefully, and on any sign of shallowness the anaesthetic should be stopped. If the breathing stops altogether, mouth to mouth artificial respiration should be done : if the stoppage is noticed in time, this method of resuscitation minimises the danger and makes for a nearly certain cure. With a piece of gauze over the mouth, the anaesthetist takes a deep breath, at the same time holding the nose of the patient. The expiratory movement then follows. After a few breaths, respiration returns.

Ether. This is the method of choice in cases of toxaemia, haemorrhage, goitre, heart disease, and kidney disease. It is entirely safe, and when given properly does not require much time or apparatus. It is given by the open method. Over an ordinary frame chloroform mask, a pad of gamgee is laid, with an opening in the centre. The ether is poured into this opening, which is covered up with another piece of gamgee to prevent evaporation. It must

not be given close to the light because of the inflammability of the anaesthetic.

Ether is given at the same stage in the labour as chloroform, and even though it is a safe anaesthetic, care must be taken in its induction.

The ideal time to give either of these anaesthetics is when pressure signs are present: if it is possible to delay the administration of the anaesthetic until this stage, it will be better for her and the baby. It is necessary to make certain that pressure is really present, and that it is not merely a bulging from straining. To make certain, feel between the anus and the coccyx.

It is important to remember that excess of chloroform passes into the infant's blood.

Intrasacral and intrathecal anaesthesia. These are both used in some clinics. We cannot believe they will ever be within the province of the general practitioner. From our knowledge we do not advise them in normal labour. Both stovaine and novocain are injected intrathecally, while novocain alone is used in the sacral canal. These methods of anaesthesia are dealt with in various papers in the obstetrical journals. We have used stovaine in many cases of Caesarean section, but it is unsuitable in ordinary labours, for its action does not last for a sufficient time.

How to mark the progress of labour. This can be done by observing the character and strength of the contractions, the intervals between the pains, and the descent of the presenting part. The first points explain themselves: the last can be done by palpation of the abdomen, by Pawlik's grip, by external vaginal examination (see p. 137), by rectal examination, and possibly by vaginal examination. It must be distinctly borne in mind that a large caput may give a fallacious idea of the amount of descent of the head.

Is it necessary to make a vaginal examination when the membranes rupture? In every case of disproportion, whether it be due to the pelvis, foetus, or to any other cause, a vaginal examination should be made at this stage. If, however, the presenting part was engaged before rupture occurred, there is no necessity for vaginal examination: in

fact it should be avoided. Our practice is—in an ordinary case—no examination.

When should the membranes be artificially ruptured?

(1) When they protrude at the vulva: they have done their work, and should be ruptured with a stilette.

(2) When the cervix is fully dilated in a primigravida, or nearly fully dilated in a multipara, when they are obviously acting as a bar to delivery.

(3) Occasionally in a case of pendulous belly, when it is wished to bring a foot down.

(4) In any case of internal version.

(5) Before the application of forceps.

(6) In a case of twins, after the birth of the first child.

(7) In accidental haemorrhage.

(8) In the treatment of hydramnios.

(9) Occasionally as a means of inducing labour.

The membranes should be ruptured with a stilette in each case: the special method of doing this in hydramnios is described on p. 305.

The third stage of labour. From the birth of the child to the birth of the placenta and membranes.

Mechanism of separation. There are two very definite theories about the mechanism of separation of the placenta.

The normal placenta is situated most commonly on either the anterior or posterior wall. Occasionally it is found on the fundus or on the lateral wall, and except in the case of placenta praevia it is situated above the internal os. Immediately the baby is born, the cavity of the uterus is diminished, and it shrinks down below the umbilicus. Following the birth of the baby, the uterus continues to contract and retract, a condition of affairs which is very apparent at Caesarean section. After a time this diminishes the area of placental attachment, blood pours out of the sinuses, causing the formation of a large haematoma: contraction and retraction, aided by the pushing power of the haematoma, separate the placenta in the spongy layer of the decidua and mechanically cause its separation from the upper part of the uterus, whence it escapes into the lower segment.

The **membranes take a little longer to separate**, and this occurs in the same way, by contraction and retraction.

This fact alone should remind the accoucheur of the necessity for waiting until he has determined that all the signs of the placenta having left the uterus are present: otherwise membranes may be left behind. Once the placenta and membranes have separated, the anterior and posterior walls are practically in apposition. The most commonly accepted theory about the separation of the placenta has been suggested in the above description. This is the method described by Schultze (see Figs. 95, 96), and

Fig. 95.

Fig. 96.

Diagrams to illustrate the Schultze mechanism of separation of placenta.

Fig. 97.

Diagram to illurstate the Duncan mechanism.

our observations confirm this—viz. that the separation of the placenta occurs from (1) contraction and retraction of the uterus; (2) the formation of a retro-placental haematoma following the pouring out of blood from the sinuses; (3) that these factors join in practically turning the placenta inside out and expelling it like a bag with the foetal surface, first followed by the membranes, which are now inverted.

We regard the second theory of mechanism, namely, that of Duncan, as an abnormality, and we believe it occurs from manipulation (see Fig. 97).

In this the placenta is extruded in the same way as a button from a button-hole, *i.e.* following separation, an edge

appears at the vulva, the rest of the placenta then follows, usually accompanied by the membranes. When this mechanism occurs, the membranes are sometimes left in the uterus. Our late colleague Freeland, with whom we worked in collaboration, reported 2,600 third stages where the Schultze mechanism was present in 82·5 per cent.

To conduct the third stage of labour. Turn the woman on her back near the edge of the bed, so that only the side of the bed gets soiled. It is easy to turn her by passing the arm under her bent knees. Be careful, when she is being turned, that she does not kick the baby. She is especially apt to do this if she is dazed with chloroform.

Advantages of the position on the back. It is the most convenient position for the obstetrician, for he can control the uterus better when the patient is lying on her back.

It prevents air being aspirated into the uterus. The heavy uterus falls over to the left side after delivery of the child, and air rushes in. Air embolus might result, or possibly infective organisms might be aspirated into the uterus. There is no real proof that either happens, but, at any rate, they are avoided by the position on the back.

The mother has lost considerable heat during delivery, and if she is not covered she will shiver. This rigor, though disagreeable, is of no significance. The room must be warm, and she must be covered by a blanket. The clothes should cover her chest, abdomen, and lower limbs. If she bends up her knees, she will save the clothes from being soiled.

See, again, that everything is ready in case of a sudden rush of blood. Consider what must be done if post-partum haemorrhage should occur. For example, the douche bag is hanging on a nail on the wall in readiness, and if a Rotunda douche is used, a chair standing on a table is ready for the jug to hold it. The hypodermic syringe, with a small bottle of brandy or ether, is on the mantelpiece. Rubber gloves are in the basin. The sterile case containing a catheter, a vaginal nozzle, and a Bozemann's catheter and perineal needles and needle-holder, and the bag with the Rotunda douche, if this is used, are near at hand. There is

cold water in the jug and a kettle with boiling water on the hob. Thus everything is ready, and if bleeding occurs, work may be commenced deliberately, without unnecessarily alarming the patient.

Attention to the child. The baby is placed on its right side, facing the mother. It is placed on the side to facilitate the escape of mucus: it is placed on the *right* side in the belief that it favours closure of the foramen ovale, but as the foramen does not close for six weeks, the futility of this procedure is evident: this position does prevent pressure on the heart and traction on the cord. So long as the cord is pulsating, the child is getting oxygen. It may be blue—if so, suck the mucus from its mouth. In private practice we use a modification of the Mercier catheter, which has great advantages (see Fig. 32): it is made of glass: the mucus can be seen and is not sucked into the mouth. Having got rid of the mucus, if still not breathing well, hold it up by its feet and slap its back—*but this should not be done until it is certain that all the mucus is away.* (It is not necessary to hold it up by its feet in a normal labour.) If it is obviously not getting on well, cut the cord quickly, tie it, and treat as for asphyxia neonatorum (see p. 627).

When to tie and cut the cord. Experiments have shown that if the cord is cut immediately after the birth, the infant is deprived of about three ounces of blood, which remains in the placenta instead of returning along the umbilical vein. It is also observed that, owing to the loss of this blood, infants who have their cords cut at once do not thrive so well as those that have their cords cut when pulsation has ceased. Therefore do not cut the cord until all pulsation has ceased.

Take the ligatures from the biniodide of mercury solution and tie the cord in two places with reef knots; wet ligatures are firmer. Cut with sterile scissors between the ligatures. These aseptic precautions are very important, for infants are occasionally lost through infection spreading from the cord. A ligature at the placental end of the cord is not essential, but saves mess, and becomes essential if there is a second child in the uterus. In the latter case the anastomosis between the placentas may be so intimate that

the second child will bleed to death if the cord is not tied on the maternal side. The second ligature should be tied on a gently stretched cord about three inches from the vulva. The cord is stretched to pull loops out of the vagina. Give the child to the nurse when the cord is cut, and see that the cut end does not bleed.

Some people believe that the membranes separate better when the placental side of the cord is left untied : we agree

Fig. 98.—Control of the uterus.

with this, and do not tie this side in private practice, having satisfied ourselves twins are not present. We do not teach this procedure in the hospital for fear that twins might be overlooked, and disaster follow.

Control or non-control of the fundus. We have come to the conclusion that *control of the fundus is unnecessary* in the vast majority of cases, and it is not practised at the Rotunda. Even if the student is carefully instructed in the method he may allow his hand to " flop " near the uterus and bring about hour-glass contraction. Unless the

pulse becomes rapid and an examination of the uterus demonstrates that it is filling up with blood, the fundus should not be controlled. If it is controlled it should be carried out in the manner illustrated (see Fig. 98). When the fundus is not controlled the pulse of the patient must be carefully observed. At the end of half an hour the doctor determines whether the placenta has left the uterus, and the remainder of the third stage is conducted as follows: The uterus expresses the after-birth into the vagina. Owing to the patient's position the after-birth will remain in the vagina for a long time. So when the uterus has expelled the placenta into the vagina express it. It is necessary, therefore, to know when the placenta has left the uterus and is in the vagina.

How to ascertain when the placenta is in the vagina.

1. The cord lengthens. This is easily seen by the fact that the cord has been drawn taut when the child was separated. This can be made more certain by putting a ligature on the end near the vulva.

2. The second sign, however, will be present. Draw the extra-vulvar cord out straight. Place the hands on the abdomen on either side of the uterus and lift the uterus towards the ensiform cartilage. If the placenta is in the uterus, it too will be drawn up, and the extra-vulvar cord will be drawn a corresponding amount into the vagina. If the placenta has left the uterus, the cord is not drawn into the vagina, unless the membranes are adherent, when it is also advisable to wait. Again, press down the fundus of the uterus gently. The lightly stretched extra-vulvar cord advances. Release the uterus, which springs back. If the placenta is in the uterus it springs back too, and the cord is drawn up into the vagina. If the placenta is not in the uterus it does not spring back, and the lengthening of the cord remains. The only exception to this statement is when the bladder is full of urine; in this case, although the placenta is in the vagina, the cord shortens when the uterus is released. The uterus should be gently ballotted from the fundus, not from the lower segment. In this way there is less chance of hour-glass contractions occurring.

3. When the placenta lies in the upper part of the vagina the uterus is perched up on it. The uterus, therefore, rises and the fundus rises sometimes above the umbilicus. Note the height of the fundus immediately after the child is born, to detect this sign. It is not always possible to detect this rising of the uterus.

4. If the uterus is perched on the placenta in the vagina, it can be readily ballotted. This is not a very reliable sign,

Fig. 99.—Expressing the placenta.

for sometimes the uterus can be ballotted freely, although it still contains the placenta.

5. The placenta in the vagina sometimes bulges the hypogastrium like a full bladder, and this bulging can be seen.

6. A sudden slight discharge of blood between twenty and thirty minutes after the birth of the baby often gives warning of the placenta having left the uterus.

Attention to all these signs will show when the placenta has left the uterus.

How long does the uterus take to express the placenta? This occurs on the average in from twenty to thirty minutes. In some cases retraction is very speedy, and the placenta is delivered immediately. If it has not been expelled in an hour, the case may be regarded as abnormal.

How to express the placenta and membranes from the vagina. Having ascertained that the placenta has left the uterus, wait for a few minutes to give the membranes every chance. It must then be decided whether the operation is to be done with or without assistance.

(1) **Third stage delivery by the accoucheur alone.**

FIG. 100.—Third stage of labour: drawing uterus off membranes.

The attendant stands by the left side of the patient, places the right hand on the fundus, and presses it downwards and backwards in the axis of the inlet: the left hand is clean and gloved and ready to receive the after-birth and support it while traction brings the membranes along with it. This method is difficult to perform, and it is better to seek the assistance of the midwife, and allow her either to express the placenta or to receive it.

(2) **Delivery of the placenta by the accoucheur and nurse.** The attendant, having waited for a contraction or rubbed the uterus up to a contraction, expresses the placenta (see Fig. 99), pressing downwards and backwards. As it appears at the vulva, the nurse receives it. If the foetal surface has not appeared first, it is turned so that it is caught in this way, for it is the safest method of avoiding

retention of the membranes. The membranes usually come away easily with simple traction on the placenta : if, however, they appear likely to tear, put the placenta on the bed or in the basin, get a firm hold of the complete circle of membranes and draw them gently away. If they do not appear likely to come, draw the uterus gently off them (see Fig. 100). We do not use the basin in private practice, for it is difficult to sterilise it properly, and an unsterilised basin must never be put near the skin of the vulva.

If the *membranes* are inclined to tear, or if they have torn off, and portions can be seen in the vagina, pass up a forceps and catch them, when they can be easily drawn down and separated by gentle traction.

We do not allow pulling on the cord. Whereas it *might* be practised in perfect safety by a skilled obstetrician, the danger of inverting the uterus is so great that it should not even be mentioned to the student.

We do not teach twisting of the membranes. If they are inclined to stay behind, draw them gently downwards, when they should peel off. Twisting commences an abnormal mechanism.

Examination of the after-birth. To examine the after-birth, first turn the maternal surface upwards, holding the placenta in the two hands. Normally, the lobes of the placenta, when it is complete, fit accurately together. Should there be a tear, the sides of the tear fit accurately when brought gently together by pressing the periphery of the placenta towards the centre. If there is a piece of placenta missing, this accurate apposition will not occur. There will be a space not filled by placental tissue.

Having examined the maternal surface, hold the placenta up by the umbilical cord, smooth the membranes down, and see if any are missing. It will be quite a simple matter to see a gap in the chorion where it has been retracted off from the placenta. The amnion is seldom missing, but its absence is very obvious.

Result of membranes being left behind, and what to do. If on examination of the after-birth it is found that membranes have been left behind, haemorrhage may result : if so, the case must be treated as such. In most

instances there will be no immediate trouble, and often there will be no remote trouble. Our routine now is to give immediately ergotamine tartrate gr. $\frac{1}{130}$ and pituitrin $\frac{1}{2}$ c.c. In the puerperium, free movements, ergotamine tartrate gr. $\frac{1}{130}$ three times daily, and quinine bisulphate grs. 5 twice daily for a few days will assist in getting rid of the membrane.

Ordinary "sapraemic" conditions may arise, when they should be treated.

Remote effects may follow the retention of membrane, such as late post-partum haemorrhage, "placental" polypi, chorion epithelioma, chronic metritis, with later fibrosis uteri.

In other words, great care must be taken to try to ensure a good conduct of the third stage of labour.

The above is the routine when some membrane has been left behind. When the placenta has come away alone, *i.e.* when the whole of the chorion is left in the uterus, it is wiser to try to get it out. We temporise to a certain extent: unless the patient is bleeding, we do not make a manual exploration: we give a long, hot, intrauterine douche, and this, without any manipulation in most cases, causes the membranes to be extruded: in addition, ergot and pituitrin are injected.

If any portion of the placenta is retained, it must be removed forthwith. Manual exploration must be done, and the cotyledon or cotyledons removed in the manner described for removal of the whole placenta. On no account must it be left to chance to get rid of portions of placenta during the puerperium.

THE PERINEUM

Although the suture of the perineum might logically be included in the chapter on operations, it is felt that this step in the case of the woman in labour is so often necessary that it is wiser to describe it here.

The perineum. The necessity for carefully inspecting the perineum, and the wrong done in leaving a laceration unstitched, have already been urged. One of two conditions is commonly seen: in one a simple central split of the perineum with firm yellowish-red tissue on each side of the

tear: in the other a tongue of vaginal mucous membrane, bruised and ragged, hangs down, as if stripped off the posterior vaginal wall. The cause of this laceration is as follows. The central raphe of the levator ani is strong. The tearing force takes the line of least resistance, and drags the bruised and stretched muscular fibres of the levator ani muscles from their attachments on one or both sides. It is in this way that the lateral tears form, and the subsequent giving way of the skin through the median raphe completes the Y-shape of the laceration. The support of the pelvic floor to the pelvic organs is impaired much more by this lateral tear of the levator ani than by a simple central tear of the perineum. Prolapse of the vaginal walls and frequently retroversion of the uterus follow eventually. More immediately there is some risk of a puerperal ulcer, unless the perineum is united.

How to examine the perineum. The patient lies on her left side, with her buttocks over the edge of the bed. A good light is essential. Sponge the parts free of blood with pledgets of cotton-wool soaked in mild antiseptic. By holding the labia well open and sponging them, the size and situation of the tear will be obvious. If there is a lateral tear running up into the vagina, it is readily seen.

How to sew an ordinary perineal tear. Sewing a perineum is least painful immediately after the birth of the child. Therefore, if the patient has had chloroform, insert the stitches while she is still semi-conscious. Either tie them at the time, or tie one knot and then tie the second turn of the reef-knot after the placenta has come away. In the case of a primigravida, have sutures, needle-holder and needles ready in the basin before the birth of the child: they are likely to be needed. We use silkworm-gut, and occasionally catgut: the latter is used for vaginal wall tears or tears of the sphincter ani. If catgut is used we advise that it be carried already sterilised in tubes which are sold by reliable firms. Numbers 2 and 3 will be found most useful.

Catgut sutures dissolve, so need not be taken out, and the patient is unaware that she has been stitched, but they may dissolve too soon, with resulting non-union. For the perineum, therefore, silkworm-gut is more reliable, and is

used by us in all ordinary tears of the perineum. We prefer the gut dyed : this can be procured from instrument makers, or a few drops of methylene blue can be placed in the water in which it is boiled. The advantage in dyed gut is that it can be easily seen for removal, and that the antiseptic contained therein is a help.

The patient is in a similar position to that already described for inspection of the perineum. Use a long needle-holder provided with a $2\frac{1}{2}$-in. fully curved needle, or, if

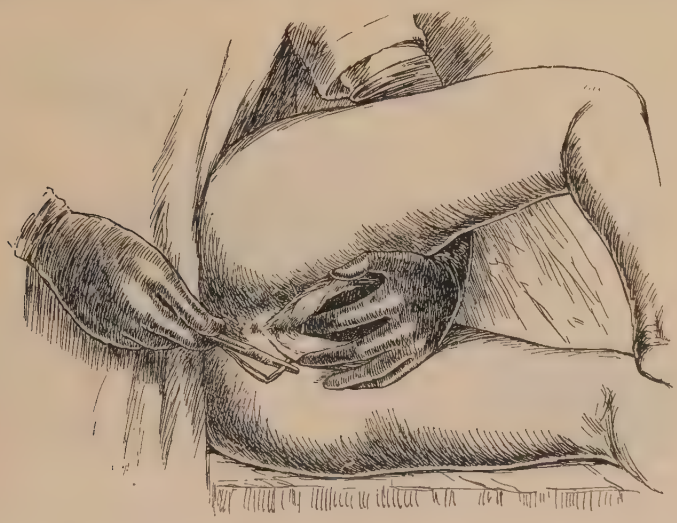

Fig. 101.—Sewing a ruptured perineum. (In the case of an extensive tear half the hand is inserted instead of one finger.)

preferred, use the needle without a holder. This needle will of itself, if passed deeply, take in thick masses on each side and so include the torn portions of the levator ani. Hold the wound open with the middle finger and thumb of the left hand, and insert the index finger into the deepest part of the wound, that it may feel the needle as it passes across deep to the bottom of the wound. Starting at the skin edge, plunge the needle down the under-side of the tear, pass it deep to the laceration and bring it along the upper-side of the tear out to the skin. Remember always to keep below the deepest part of the wound and parallel to the course of the rectum. Insert the stitch that is nearest

the anus first, for this will be the most important. When the inserted needle is lifted the entire torn surface should be lifted up on it, in this way showing if the deepest parts have been included. Do not tie until all the stitches are inserted, and then tie them with three or four reef-knots and leave the ends long. If the parts are very ragged and oedematous, do not tie too tight, for the stitches may cut their way out. Unless the torn tissues are very damaged or have become infected, they unite by first intention. The vulvar pad is sufficient dressing. Long ends do not prick the patient,

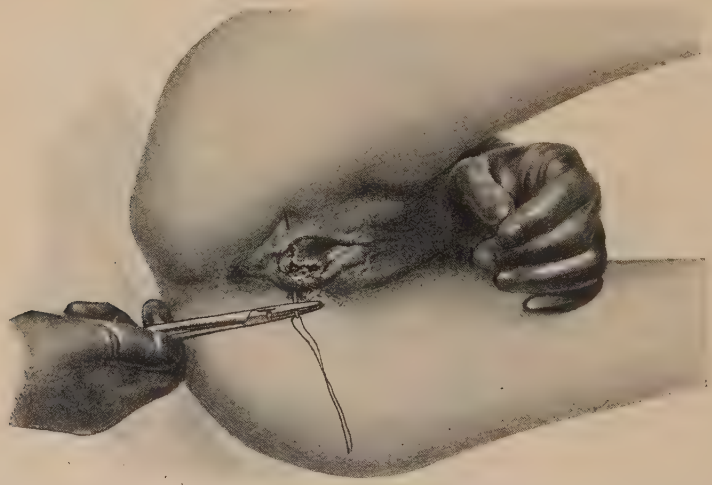

Fig. 102.—Sewing a ruptured perineum. (The fingers of the left hand are withdrawn to show how the needle is inserted.)

and if silkworm-gut is used, the sutures are more easily removed. Tying three or four knots keeps silkworm-gut from cutting in too much, and the sutures are not so hard to find when they are being removed. If the vagina is torn high up it must be stitched with catgut.

Can a perineum be sewn up later than the day of delivery? Clean granulating surfaces unite readily when brought together by stitches. Therefore, whenever there are raw surfaces they should be united by sutures.

The pulse of the mother. Count the mother's pulse at intervals throughout labour, especially in the third stage, and afterwards. The pulse should then become slower. If,

on the other hand, it becomes faster, see if the uterus is filling with blood, is big and flabby, or if there is external haemorrhage. Patients who have been given chloroform are apt to have a rapid pulse, which is of no significance.

Cleaning the patient. In private practice we always wash the vulva ourselves. Put the patient on her left side, with the hips over the side of the bed. Separate the thighs enough so that she can be sponged efficiently, but if the perineum is torn, both now and during the puerperium the thighs must not be widely separated. Use pledgets of sterile cotton-wool soaked in weak lysol (half per cent.), and wipe from before backwards, throwing away each pledget after one wipe with it. Lysol washes away the clotted blood that clings to the vulvar hairs better than any other antiseptic, and avoids the necessity of soap and water. It makes the patient smart if too strong. Do not open the labia, but wipe over the closed vulva. It is necessary to wipe the mucous surfaces of the labia minora only before a vaginal examination, and vaginal examinations are not needed after the child is born. Tell the nurse to clean the vulva in a similar manner during the puerperium. It is better than wiping into a bed-pan, which is also used for the evacuation of the bowels. If the nurse asks how often she is to do this, tell her as often as the lochia shows through the aseptic pad, and at least every six hours. A stitched perineum is often prevented from healing by receiving too anxious attention from the nurse.

Warn the nurse against pressing on the buttocks whilst washing the vulva. A recently healed wound is frequently severed by such manipulation.

The pad. When the vulva has been wiped, the patient is turned on her back again. Then raise her back and wipe her buttocks dry with a towel. At the same time the nurse pulls away the draw-sheet and upper mackintosh into the bath. Put the pad between her legs, and she then lies down on the binder. The pads are made of gamgee tissue, and are about ten inches long by four inches wide and two inches thick. They are scorched brown on one side at the fire, and the scorched part when cool is put next to the

vulva. Dry pads are better than wet ones. Wet pads are uncomfortable and have little virtue as antiseptics.

Uses of the binder. The binder brings a sense of support to the patient, and as a rule patients like to have it for this reason; also pain may be experienced owing to stretched pelvic joints following operative delivery. It also keeps the legs together, if the perineum has been torn. Puerperal women, too, suffer from flatulence, and a binder opposes the distension of the abdomen.

How to fit the binder. If the patient is not already lying on the binder it is slipped in under her. The lower border should be at least two inches below the trochanters. Pin the binder from below upwards, with the edge furthest away overlapping the one nearest. Four stout pins are needed. Make it tight by pulling the ends in opposite directions, passing one hand under the other and nipping the binder with thumb and finger before pinning. We use stout straight pins, and pin transversely, leaving the point of the pin between the folds of the binder. One pin is fixed near the lower border of the binder, the next over the pubes, the next between the pubes and umbilicus, and the last, which need not hold so tightly, above the umbilicus.

The proper placing of the second last pin requires further explanation. It should hold in a firm grip the portion of the binder which lies just above the fundus.

Before it is inserted the fundus should be contracted and forcibly anteflexed. The binder can then be made to slip behind the uterus and keep it fixed in this anteflexed position. A firmly anteflexed uterus does not bleed, and will not overfill with clots.

When to put on and take off the binder. It is usual to put on the binder about half an hour after the delivery of the after-birth, provided there is no post-partum haemorrhage. It is worn until the patient begins to walk about.

The baby. The infant has been wrapped up in a blanket or in flannel and put on the bed or elsewhere, whilst the mother has been made comfortable. Take the infant and examine it for defects, such as cleft palate or imperforate anus. If there is any suspicion that the mother has had a vaginal discharge during pregnancy, drop two drops of

1 per cent. solution of silver nitrate into each eye. This prophylactic, recommended by Credé against ophthalmia neonatorum, is of the greatest importance and should always be used.

The baby's toilet. The best way to get rid of the vernix caseosa is to rub the skin with a little oil before using soap and water. It disappears of itself in a few hours. Do not let the nurse put enough water in the bath to cover the baby. The temperature should be about 100° F. Dry the cord carefully. We think a small sterile pad of cotton-wool scorched at the fire on both sides as good a dressing as any for the cord. Dust it with a powder of boracic acid 1 part, zinc oxide 3 parts, and starch 6 parts. Slit the scorched pad to the centre, slip the cord along this slit and fold the pad over the cord. See that the swather is not too tight to allow the freest respiration. Fuller's earth may contain the spores of tetanus, and therefore is not to be recommended as a dressing. Sewing the clothes on is better than pinning them, for a pin may run into the baby.

Ergot. We now use the most active principle of ergot, ergotamine tartrate. It is given in either tablet or hypodermic form, and is sold as a preparation called "Femergen." The tablets contain $\frac{1}{150}$ of a grain. The ampoules each contain 1 c.c., which is a suitable dose.

When to leave. In a properly conducted case of midwifery, the attendant should not leave until an hour has elapsed from the delivery of the after-birth. Little complications may arise. The infant's cord may bleed. The uterus may fill with blood-clots and discharge them, which may be accompanied by alarming shock. True post-partum haemorrhage may occur. Such cases are not rare.

Watch the pulse and see that it becomes slower, or, at any rate, not faster. Occasionally feel the uterus to see that it keeps well contracted and retracted. Take the patient's temperature and pulse, and make a note of them, with the nature of labour, in the casebook. Tell the nurse to put the infant to the breast for a few minutes, when she is ready to do so. This trains it to the nipple, stimulates the milk flow, and helps the contraction of the uterus. Let the patient sleep, but do not draw down the blind, for in

the dark any facial pallor, due to loss of blood, cannot be detected. She may have some toast and tea, if she wishes it. Tell the nurse to see that the patient passes urine within eight hours. The best way she can do this is to roll over on her hands and knees. No harm results from this even after the perineum has been sutured. Having given these instructions, she may be left to the nurse's care.

Signs of recent delivery. In endeavouring to determine whether or not a woman has been recently delivered, the following points should be taken into consideration: Note the condition of the striae gravidarum; if of old standing they are of a pearly white colour, when very recent their colour is almost a salmon pink. In multiparae recent and old striae may co-exist. They are merely proof of extreme abdominal distension, and therefore are a very probable indication of pregnancy having existed. The state of the breasts should next receive attention; in the puerperium they are swollen and turgid, the areola is dark; in the first few days colostrum can be expressed; the detection of colostrum corpuscles is said to be a proof of recent delivery; later on milk may be present in considerable quantity. If the fact of delivery is trying to be concealed, the flow of milk may have been stopped by bandaging the breasts. Milk can sometimes be expressed from the breast of a multipara who is not and has not recently been pregnant.

The signs of recent delivery as found in the cervix and vagina and lochia are mentioned on p. 178.

A decision can usually be made as to whether or not a patient has had an approximately full-term confinement, but unless seen within a few days of the event it may be extremely difficult or impossible to determine the date on which it took place.

It may not be out of place here to give a word of warning; whenever it is necessary to terminate pregnancy artificially, the reasons for doing so should be communicated to the husband and his consent should be obtained. A consultation with another medical man should be a routine. This is more particularly necessary when the operation is undertaken in the early months of pregnancy.

CHAPTER VIII

THE PUERPERIUM : ITS PHYSIOLOGY AND MANAGEMENT

The Puerperium may be defined as the time when a woman is recovering from the effects of childbirth.

After the birth of the child the abdominal walls are slack, with more or less separation of the recti, the striae gravidarum are present and have not assumed the pearly-white colour seen in striae of old standing. Striae are an indication that considerable abdominal distension has been present, and hence they are good evidence of pregnancy, if other causes of distension can be eliminated.

The changes which occur in the uterus. After delivery it is seven or eight inches long, and it weighs nearly two pounds : two days later, the weight is one and a half pounds : in seven days it is five to six inches long, and three-quarters of a pound in weight.

The process by which it returns to normal is called **Involution.** It takes from ten to fourteen days to get back to the true pelvis : it takes about six weeks to return to its pre-pregnant condition : this latter point is a reminder that at least six weeks should be allowed to elapse before any operation is done after delivery. Immediately after delivery the uterus is at the umbilicus, the average height being a little more than five inches from the symphysis pubis : on the twelfth to fourteenth day it is just above the pubes. The process of involution is extraordinarily interesting, and the method of its occurrence has been described by various observers. The fibres become much shorter and narrower : autolysis of the fibres occurs. Their protoplasm is broken down by proteolytic ferments into more simple products which are removed chiefly by the urine : this has been proved by the excessive nitrogen contents of the urine during the early days of the puerperium.

There is also a fatty degeneration in the muscle fibres and an accompanying fibrosis of the blood vessels.

At the time the placenta is expressed, the cervix hangs down quite freely, but at the end of twelve hours the os internum has closed down to such an extent that a little force will be required to get two fingers through it. Immediately or soon after the third stage has ended, the lower uterine segment collapses, and the retraction ring and the external os are practically one.

The uterine mucosa also undergoes change. Part of the cavernous layer of the decidua remains. Immediately after birth, the cavity is an open wound: this is well seen at Caesarean section, and the ease with which infection can occur is easily understood.

In six to eight weeks the mucous membrane is reformed by proliferation of epithelial and connective tissue elements: part of the decidua comes away in the lochia.

An interesting change occurs in the **blood vessels.** A certain amount of thrombosis occurs at the sinuses: these thrombi later become organised. Goodall has observed that the old vessels disappear and new vessels replace them. New vessels are apparent in the organised clot in the lumen of the disappearing vessels. Gradually, new connective tissue is found supplying the new vessels. A process of degeneration occurs in the partly absorbed old vessels with the formation of elastin. The discovery of this substance may be taken as a proof of parity, and is described in detail by Fletcher Shaw, who terms the process "Vitreous Degeneration."

The lochia is alkaline in reaction in the uterus but becomes acid in the vagina. This discharge is bloody for the first few days, passes gradually from that colour to brownish, then to a whitish colour prior to its complete disappearance. Microscopically it presents a valuable sign of recent delivery, for in addition to blood and epithelial cells, decidual particles may be found. The odour of the lochia is quite distinctive. Bacteria are nearly always present, but often they are quite harmless.

Other changes in the puerperium are—

(1) In the blood both the anaemia and leucocytosis gradually disappear.

(2) There may be some diuresis at first, and lactose may be present in the urine.

The care of the normal puerperal woman. At the end of the third stage the patient is very cold and is subject to shock: she must therefore be kept very warm, and hot drinks should be given to her. The uterus should be "rubbed up" to express clots, and the puerperium starts.

The doctor has a definite routine to follow, and he must attend his patient regularly if good results are to be obtained, and if his practice is to remain satisfactory.

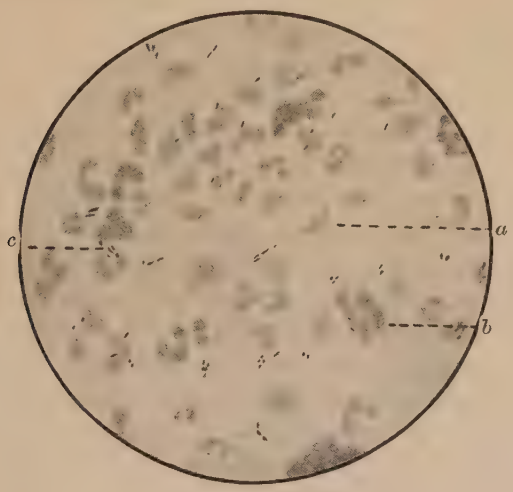

FIG. 103.—Smear of normal lochia. Third day.
a, leucocytes; *b*, red blood cells; *c*, non-pathogenic bacteria.
(*Rotunda specimen. No.* 60, *Ward No.* 7.)

The first visit should be made within twenty-four hours of the birth of the child. Daily visits are paid for the next seven days. During the second week it is sufficient to see the patient every second day, unless something abnormal arises. She is discharged at the end of a fortnight, and told to come for examination at the end of six weeks.

When the doctor comes to the house, he should remove his overcoat, otherwise he does not look very workmanlike. He should not smoke in the room. He should enter quietly and set about his duties. The chart (see Appendix) should first be examined: he should insist on the nurse keeping charts carefully. On it will be seen the temperature and

pulse records, rate of involution, condition of lochia, bowels, etc., in addition to the state of the infant.

He should inquire about the breasts, and if the baby is nursing well, the amount of sleep, the voiding of urine, food, and see that the room is properly ventilated.

Temperature. This should be taken in the mouth at a convenient time morning and evening: 8 a.m. and 6 p.m. are suitable, but so long as the same time is adhered to each day the exact hours are of little moment. A half-minute thermometer should be used. During the first twenty-four hours there may be a slight rise: if, however, it is raised above 99° F. after this, a cause must be sought.

The pulse. Similarly, if the pulse-rates after the first twenty-four hours rise above 90, a cause must be sought. The temperature then should remain at or below 99, and the pulse at or below 90 in a normal puerperium. In a nervous patient the pulse-rate rises when the doctor goes into the room, but falls as she gets accustomed to his presence.

Involution. This process has already been described. It is most important that its rate should be noted, for by observation the cause of abnormalities is discoverable. The rate of involution varies greatly in women, and little is gained by learning how high the uterus should be on a particular day. What should be noted is the gradual nature of the process. If a sudden dropping of the uterus occurs, it suggests the sudden bending forwards or backwards of the body of the uterus, namely, acute anteflexion or retroflexion, and these conditions are usually associated with sudden absence of lochia and a rapid rise of pulse and temperature.

The lochia. The lochia is collected on a pad, and the nurse should keep the last one in case the doctor should desire to examine it. We use dry sterile pads, which are either sterilised in the ordinary way or are scorched in front of the fire. We tried pads soaked in antiseptic and discarded them, as our results proved more satisfactory when dry pads were employed.

Dry pads are better in every way: they are more comfortable and are not so apt to rub faeces from the anus towards the vulva. These should be changed as often as

the patient gets uncomfortable, or after her bowels move. The description of the lochia has already been given (see p. 178). Formerly, lochia used to be described as being Rubra, Serosa and Alba, but this is incorrect, and the change taking place is as just described.

The most important points about the lochia are (1) that there should be enough, for any sudden stoppage is a dangerous symptom; (2) in the case of involution of the uterus, to note the gradual change in the nature and amount of discharge from day to day, rather than its exact nature on any particular day. Tell the nurse to look for blood-clots or pieces of membrane in the lochia, and a foetid or heavy smell from the discharge should always be regarded as a serious condition and reported at once to the doctor.

Persistence of the red colour of the lochia is not uncommon, and in some women it lasts three, four, or more weeks without demonstrable cause. Occasionally the cause is retroversion of the uterus, and practically always, with or without retroversion, red lochia is an indication of subinvolution. If the lochia remains red after the fourteenth day, examine for retroversion of the uterus: if present, replace it. If the uterus is in good position, give ergotamine tartrate gr. $\frac{1}{130}$ three times a day. We do not advise keeping a patient in bed unless the amount of blood lost is very great.

The breasts. If the breasts are squeezed on the day of delivery, a yellow fluid exudes from the nipples. This is called Colostrum. The colostrum is replaced by the milk on the third or fourth day. Before nursing the baby, cleanse the nipples with clean cotton-wool and clean water. After nursing, wipe away any remnant of milk with damp cotton-wool, and then wash with eau-de-Cologne, or some other alcoholic preparation, to harden the epithelium. The breasts should be supported by a proper-fitting breast support. The nipples should be protected by a nipple shield (see Fig. 104): these are an excellent protection for cracked nipple.

Fig. 104.—Wansboro's nipple shield.

The bowels. A woman is apt to be constipated whilst

she is lying in bed, and it is well to get the bowels moved early. If the baby is born before noon the purgative should be given in the early hours of the next morning: if after this, the same rule applies; *e.g.* baby is born on Monday at 11 a.m., the purgative at 2 a.m. on Tuesday; if at 4 p.m., wait until Wednesday morning. Mist. sennae co., castor oil, or a pill of compound colocynth and blue mass will be effective. An enema may be necessary. We let her sit up on the bed-chamber when the bowels are opened. Give her medicine (cascara as required) after this to keep her bowels opened once a day. We do not find that a purge to the mother often affects the child.

The urine. From the first, the patient may roll over on her hands and knees or sit up to urinate, keeping her thighs pressed together if she has had a torn perineum. If this fails, if she has not urinated for twelve hours and the bladder is full, pass a catheter by sight, first sponging the opening of the urethra with biniodide of mercury (1–2000). There will be no need to pass a catheter again in a normal case. Avoid doing so, if possible, for a woman is liable to get a catheter habit. Some women do not empty the bladder sufficiently, and a large accumulation results, forming a palpable tumour, dull on percussion, above the pubes. A full bladder is frequently mistaken for the uterus. It has a very similar shape, but causes more bulging of the hypogastrium, and has the elastic feel of a cystic tumour. Careful palpation reveals the contracted uterus pushed up and to one side, usually the right, where it lies under the liver. Mistakes occur from carelessness and not from any difficulty in recognising a full bladder.

Some women apparently urinate normally up to several ounces at a time, but do not completely empty the bladder, as can readily be determined by palpating the abdomen after urination. If the bladder is empty the uterus occupies the middle of the lower abdomen, and the fundus is approximately at the level proper to the period of the puerperium. When the bladder is not emptied at each urination a gradual accumulation results until some time, from the fifth or sixth day of the puerperium, attention is drawn to it by acute retention of urine, hypogastric distress, frequent pas-

sage of small amounts of urine, or by the nurse awakening to the presence of a growing instead of diminishing tumour above the pubes. Such a complication is likely to lead to cystitis and its accompanying train of evils (see p. 509).

Diet. For the first two days the diet should be light. Our patient in hospital has soup, milk, bread, and arrow-root. After the bowels have acted, she may have fish, and after that anything she can digest. She should not eat enough to give her dyspepsia. Let her have plenty of fluid and milk, only at her meals. She may have stout if she likes, and it certainly seems to have some effect in increasing the supply of milk. Otherwise, no alcohol is desirable. In other words, she may eat her ordinary diet without condiments. The diet of the nursing mother is further described in the section on the infant (p. 642).

Drugs excreted in milk. It is important to know this. The following are the chief : (1) Probably all volatile oils, especially oil of turpentine and oil of copaiba. Both of these render the milk so unpleasant that the child will not take it : they " repeat " in the same way as onions. (2) Purgatives such as sulphur, senna, rhubarb, jalap, scammony, castor oil. These may act beneficially or otherwise. (3) Opium. (4) Iodine, potassium iodide. (5) Metals such as antimony, arsenic, bismuth, lead, mercury, zinc. Arsenic is often given in tonics, and in small doses does no harm to the baby. Mercury may cause salivation. (6) Salvarsan. Advantage is taken of this drug and its derivatives in pregnancy to produce a healthy child, and in the puerperium to cure the suckling.

Sleep. This is most important both for the welfare of the mother and, as the absence of sleep affects the milk supply, of the child.

We said that the puerperal patient requires extra sleep, and we have the room closed for two hours every afternoon, so that she may get rest if not sleep. The nurse should try to have her ready for the night at a reasonable hour, for she may be disturbed by the baby : if the latter is troublesome, arrangements should be made to keep it in another room temporarily. A mild hypnotic does no harm and may do good. Aspirin grs. 5 or pyramidon grs. 5, or

even something stronger, may be extremely useful. Absence of sleep may indicate infection, and may be the forerunner of insanity.

The room. See that the windows are kept open, and that the room is not stuffy. An open window day and night is good for the baby, and will not give it cold. The mother can have the blinds down if she likes, but there is no need

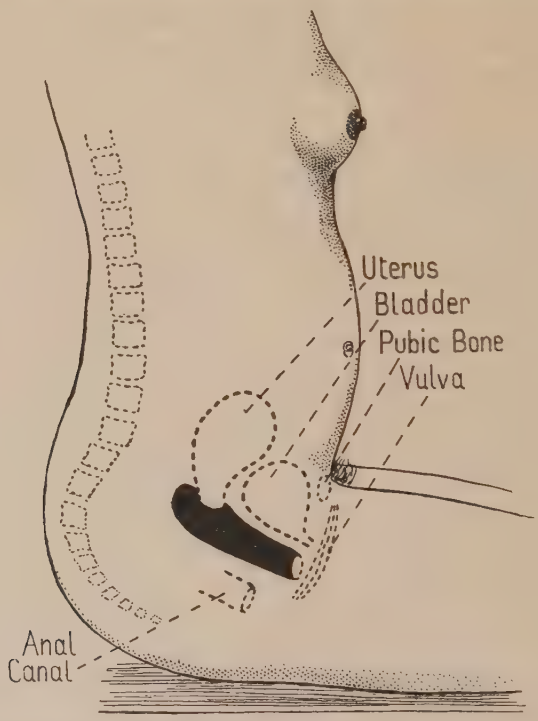

Fig. 105.—Decubitus in the puerperium. Correct position.
(From Theobald's *Nursing Obstetrics*, by permission.)

for them to be down. It is not well to treat her too much as an invalid, for women are very open to suggestion, and are ready to fancy themselves delicate if others suggest it to them.

Visitors. On general lines, visitors do harm. At the Rotunda there are some mild cases of pyrexia every visiting day. During the first week we allow the husband and the mother to see the patient. After that, one or two visitors daily are permitted.

After-pains. After-pains are usually due to clots in the uterus. Massage the uterus, squeeze out the clots, and give ergot ʒj twice a day. Aspirin grs. 10 is a simple and effective remedy.

When can she get up ? Hand in hand with this is the decubitus of the patient. She should sit up in bed as illustrated in Fig. 105 after the first day: this ensures thorough drainage. Fig. 106 demonstrates the position actually antagonistic to drainage. Generally speaking, we keep our patients in bed until the uterus has become a

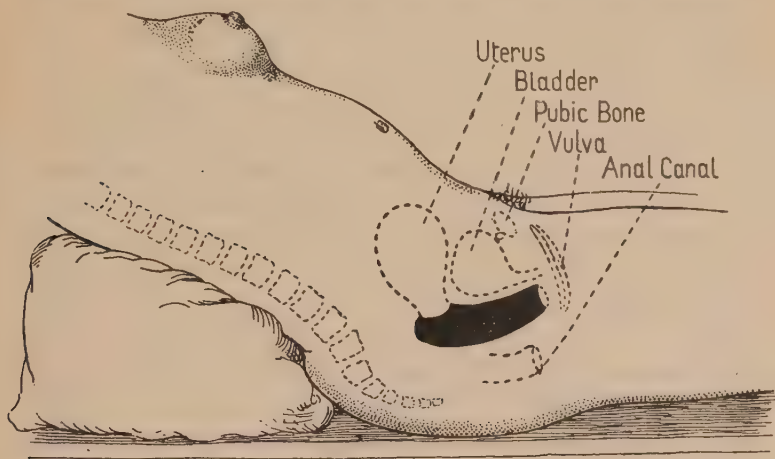

Fig. 106.—Decubitus in the puerperium. Incorrect position. (From Theobald's *Nursing Obstetrics*, by permission.)

pelvic organ, and the lochia has ceased or is very slight, that is, between the tenth and fourteenth days. If the lochia becomes red as the result of getting up, the patient had better stay another day or two in bed. A woman should not stay in bed longer than a fortnight, unless there are good reasons for doing so. Our hospital patients get up on the sixth or seventh day, and go out on the eighth. We think this is too early, and it only occurs because of special conditions.

A patient should be encouraged to move about freely in bed, and she should sit up with a bed-rest on the fifth day: if the perineum is intact, she may rise from bed on the following day, and get downstairs by the fourteenth. If,

however, the perineum is torn, she should remain in bed for twelve days.

To sum up :

	When perineum is intact.	Torn.
Sit up well in bed . .	5th day	5th day
Get up out of bed . .	6th day	12th day
Downstairs	14th day	16th day

Early rising. Within recent years there has been a revival of early rising in the puerperium. Patients, unless contra-indications exist, are got out of bed into a chair for a short period within twenty-four hours of delivery, and after that daily, the intervals being shortened, and the sitting-up periods gradually lengthened in accordance with the needs of the individual patient. The arguments in favour of this course advanced by its advocates are similar to those advanced a generation ago for keeping a patient in bed for three to four weeks. Our opinion is, that the majority of women have earned a rest, and that they get better more quickly and smoothly if kept in bed and are not given any extreme treatment either of rest or early rising. The benefits and ill effects of early rising are more or less intangible, and not immediately manifest. If it became universal there would probably be an increase in the number of "nervous breakdowns" in the lactation period. Judgment is needed in selecting proper cases for early rising, and in regulating the speed of convalescence. The recent fashion for exercise and the outdoor life has caused a forgetfulness of the benefits of rest. The aim of the puerperal and lactating woman is the proper nourishment of her child, and not the return to physical fitness for the athletic and social demands of modern life.

In fact, to sum up the situation, if a patient is normal follow the lines suggested above. If, however, the patient prefers to stay in bed for two or three weeks, let her do so : she deserves it.

Exercise during the puerperium. Muscular tone is often very deficient after childbirth, and the condition is

apt to be made worse by prolonged stay in bed. For this reason it is desirable that early efforts be made to exercise the different groups of muscles throughout the puerperium. Voluntary movements of the legs, arms, and abdominal muscles can be made in the manner that will suggest itself to any intelligent practitioner. Pleasant fatigue should be aimed at, and exhaustion avoided.

Douching. Normal cases need no douching either before or after micturition: in fact douching in the puerperium is seldom practised nowadays.

Care of the teeth. Bad teeth should be attended to when discovered. If possible, any drastic treatment should be avoided until after the birth. The patient should not be allowed to continue in suffering, and the teeth should be filled or removed under nitrous oxide and oxygen. The best treatment is prevention—the use of an alkaline mouth wash, such as milk of magnesia.

PART III

ABNORMAL PREGNANCY

CHAPTER IX

THE TOXAEMIAS OF PREGNANCY

There can be no doubt of the fact that a pregnant woman is much more liable to be affected by toxaemia than a non-pregnant woman, although the definite causes of this toxaemia have not been ascertained. We are, in fact, very ignorant of the aetiology of the toxaemias of pregnancy, yet it seems reasonable to regard the presence of the chorionic villi floating in the blood of the uterine sinuses as an important factor. Until the foetus is born it is a parasite upon the mother, and adds its demands for nutrition, and the need of the elimination of its waste products, to the normal economy of her body. Owing to its presence the mother is compelled to eat more than is her wont, and probably the food she takes is also an important factor.

In the control of the metabolism of the body, the liver is the important agent, as are the bowels and kidneys in the elimination of waste products. Hence any defect of the liver or kidneys, or any sluggishness of the bowels, will subject the pregnant woman to the danger of deficient control by the liver of the products of her metabolism, or deficient elimination of them by the bowels or kidneys.

One is not surprised, therefore, to find a periodic tendency to the toxaemia coinciding with the changes in the pregnant woman, and that this toxaemia in its severest forms is associated with pathological changes in the liver and kidneys.

Further evidence that the toxaemia of pregnancy is due to retained albuminous products of metabolism is afforded by the effect of treatment. Decreasing the metabolism of the patient, diminishing her solid and especially her nitrogenous food, and increasing her eliminative and diluent

powers by means of purges and large draughts of water, can mitigate the severer forms of toxaemia and can cure the minor forms.

As regards its general character, the toxaemia of pregnancy does not differ, either in its minor or major manifestations, from other well-known forms of toxaemia. Thus headache, cramps, metallic taste in the mouth, vertigo, lethargy, pruritus, loss of appetite, nausea, flashes of light before the eyes, tremors, loss of memory, irritability, insomnia, or melancholia, are all common manifestations and warning symptoms of the toxaemia of pregnancy and of the toxaemias that occur in yellow fever, uraemia, diabetes, and phosphorus poisoning. In the more severe symptoms a similar resemblance is found. Thus convulsions, severe or black vomit, delirium, and coma are common to many toxaemias besides that of pregnancy.

Furthermore, pathologically, these toxaemias show similarity to one another. Thus the liver is always affected. Acute hepatitis with cloudy swelling, granular degeneration, or focal necrosis is found. The kidney is acutely congested, or inflamed, in many cases, and closely resembles the kidney of scarlatina. The spleen, brain, blood, and other organs are affected in varying degree.

The alkalinity of the blood in the toxaemia of pregnancy is also diminished, and the nitrogen excreted from the body shows increased ammonia, and decreased urea coefficients. The toxaemia of pregnancy is thus allied to the "acid intoxications" which occur in starvation, fever, diabetes, severe gastro-intestinal diseases, severe anaemias, and other diseases. It is interesting to note that acute yellow atrophy and pernicious anaemia have been found by physicians to be relatively more common in pregnant than in non-pregnant women.

All of these diseases have this in common, that a careful attention to the hygiene of pregnancy, to diet, to sleep, to exercise, and to the action of the bowels and kidneys, will either prevent them, or certainly decrease the liability of the patient to them. With increased research the nature of the toxaemia of pregnancy is becoming better understood, although it is still undiscovered.

It is important to remember that there must be some retention of nitrogen to make up for the weight of the placenta and foetus: also that during the first half of pregnancy the amount of nitrogen excreted is more than that taken in by the food, because protein disintegration means a greater nitrogenous excretion.

Theory as to their nature. The serum tests for pregnancy have advanced our knowledge as to the nature of the toxaemias.

Most of these tests depend on the demonstration of a foreign albumin in the maternal blood, which is probably derived from the chorionic villi. Some of these villi float free in the circulation, and have been found even in the lungs.

They provide a toxin which must be neutralised by special anti-bodies, and their failure to do so in a perfect manner is held to account for the disturbances of early pregnancy.

The want of balance between these factors may be of a slight or severe degree, and it thus becomes possible to group the toxaemias through all their grades, from the early morning sickness of pregnancy to the fatal affection of acute yellow atrophy of the liver.

The toxins of the pregnant state are no longer looked on as stable chemical compounds of the urea group, *i.e.* carbonate of ammonia, etc., but are considered rather to be tox albumins and as such are incapable of elimination.

We have been quoted in the past as stating that the "cause of eclampsia is in the gut," "food causes eclampsia," etc. Both these bald facts are incorrect. We know full well that food is one of the common factors, but we are also in entire agreement with Young and others, who state that the disease is of toxic origin, that this toxin is almost certainly derived from the placenta, either from its chorionic villi or from placental infarcts or blood. The fact remains that the exact toxin has never been found and it is probable that it is circulating in the blood of the patient. The destructive changes found throughout the body are due to the action of this toxin. Various hypotheses have been put forward to explain decidual and other anatomical changes found in eclamptic patients, but such do not afford

a satisfactory explanation of the disease as a whole. The high arterial tension, the haemorrhages, the anaemia of the brain, the cell necrosis, and the fits have all been attributed to vasomotor spasm. Vasomotor spasm may, and probably does, add to the severity of the disease, but there is no evidence that it is a cause and not an effect of the disease. Severe haemorrhages have been found where the arterial blood pressure was not high, and in cases where it is highest no haemorrhages may be found. It is just as reasonable to believe that the haemorrhages are due to the action of a haemolytic toxin as to believe that they are due to high arterial tension.

Among those who believe that the disease is due to a circulating toxin, there is much difference of opinion as to the origin of the toxin. Some believe that it results from an accumulation in the blood of the normal products of the foetal and maternal metabolism, such accumulation causing over-strain and destruction of the excretory organs. It is, however, unlikely that the excretory organs would be unable to deal with the normal products of metabolism even if these were present in excess in the circulation. Further, a young primigravida is more prone to the disease than an elderly multipara, whose excretory organs might be supposed to be less efficient, and the loss of one kidney does not in any way predispose to the disease.

It is believed by many that the toxin which causes eclampsia is produced by the ovum, and particularly by the chorionic villi which have been found floating in the maternal blood. This explanation, however, does not assist us much, since it does not explain why toxaemia occurs in some patients and not in others. Some other factor is necessary to make the explanation complete. We know that certain food-stuffs disagree with certain people, though they are perfectly harmless to others. Even the capacity of an individual to assimilate a certain food changes, so that a food which at one time may be taken with impunity, at another time acts as a virulent poison. Such changes are not uncommon in pregnant women. It is well known that all foreign proteins must be changed by the ferments of the body before they can be assimilated, and if they are absorbed

without undergoing such change, they act instantly as most virulent poisons. Eclampsia may be explained in this way. On entering the body this toxalbumin must be neutralised by the ferments (anti-bodies) already present if its destructive effect is to be avoided.

It is reasonable to conclude that the ferments which effect this neutralisation are those which fix the amino-acids derived from food. These acids are not inexhaustible, as proved by the sickness and exhaustion which may follow the ingestion of certain foods, such as eggs and lobsters. Similarly, we may suppose that the ferments are used up in the effort to counter the placental toxin; and the blood in this exhausted state can no longer deal effectively with additional toxins in the form of food particles, the derivatives of which will now act as an irritant poison, destroying either directly or indirectly the liver and kidney cells, and bringing on the well-known symptoms of eclampsia. It must not be forgotten that the irritant poison present in the blood at this stage cannot be eliminated until its corpuscles get broken up into some less harmful product, such as urea. The absorption of these foreign proteins in this unprepared state is the determining factor in eclampsia. This seems to us a complete explanation, which is not contradicted by any known clinical fact, and, further, is certainly much more fruitful for purposes of treatment than any that has previously been put forward.

Our views may be summed up by the following tables, which show that if toxin enters the blood stream by chorionic villi in blood sinuses or from placental infarcts, and is accompanied by excess of food, toxaemia results.

Food Poisons plus Toxins of Pregnancy

Enough ferment for both

No Toxaemia.

Excess of Food Poisons (Amino-acids, etc.) plus Toxins of Pregnancy.

Insufficient ferment for both, *i.e.* ferment used up for Pregnancy Toxins.

Insufficient Neutralisation.

Toxaemia.

Before considering in full the clinical data with regard to toxaemias, we must endeavour to determine whether we can classify or diagnose them as hepatic, nephritic, or both, and whether it is possible to diagnose a toxaemic condition from an hysterical one.

In theorising on this subject further we shall try to put known facts forward, but we know well that biochemical findings in many instances are open to correction.

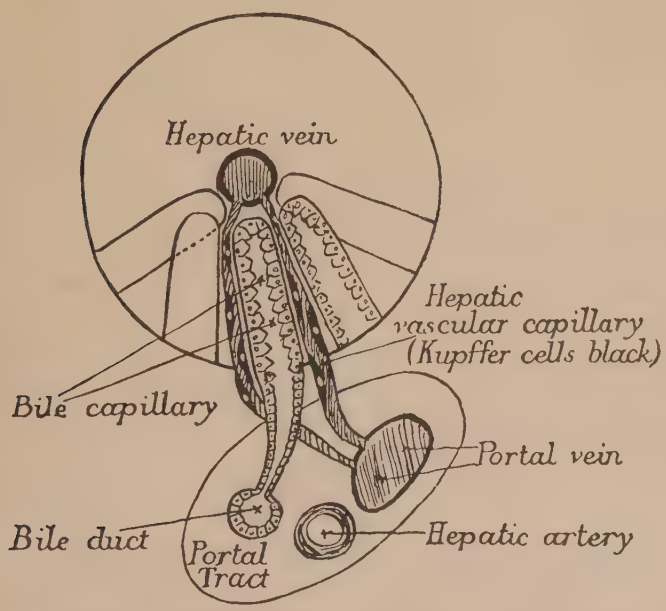

FIG. 107.—Diagram of structure of liver lobule (after McNee).

In view of the frequency of liver involvement it seems wise to consider the condition in the actual liver lobule.

It is well known that the portal vein, hepatic artery, and bile duct enter the liver surrounded by a connective tissue capsule and branch repeatedly in the substance of the organ. The branches of the portal veins surround the lobules as the interlobular veins, and from these vessels and their accompanying arteries blood passes between the columns of liver cells to reach the centre of the lobule to drain into the interlobular part of the hepatic vein. *It is known that the blood spaces in the interior of the lobule are*

incompletely lined with endothelium, so that the blood is in contact in places with the liver cells. The toxaemic condition results in inability of the blood to traverse the lobule when the effect of venous obstruction is added to the destructive element. This is a most important statement and indicates the reason for the gross involvement of the liver in toxaemia. The relationship between the liver cells, vascular capillaries, bile channels, and lymphatics is well shown in the accompanying diagram (Fig. 107). The structural relation of the hepatic cells, bile ducts, and the blood between the tubules is "ideal, as the liver has to transpose and modify many of the constituents of the blood," but when metabolism is upset, as it is in toxaemia, it is plain to see how the liver will be affected. (Some of the views expressed above, and the diagram, are taken by permission from Dr. Samson Wright's *Applied Physiology.*)

Following on these theories an effort must be made to diagnose, apart from clinical methods, whether a given case is hepatic, nephritic, or both—or even if the condition is hysterical. We have no doubt that the ward is the place to learn all obstetrics, and experience in toxaemia is a typical example of this; but the laboratory must be used as an aid, for it will help the clinician, and by its help certain things will be learnt about a case which can be acquired in no other way.

We have made, in collaboration with Dr. Bourke at the Rotunda Hospital, a great many experiments in cases of toxaemia, but our researches tally in their inconclusiveness with those set forth in the recent report from the Medical Research Council by Cruickshank and others.

It is easy to understand that the trouble is either in low metabolic power on the part of the liver, or deficient excretion on the part of the kidneys. The *absence of albumin in the urine is no proof* (although it is a strong indication) *of the absence of toxaemia.* Even if the case may be hysterical, it is just as likely to be due to a severe liver toxaemia. The tests which have been found of use are mentioned in the Appendix (see p. 727).

Before going further into special toxaemias it is well to consider the biochemical changes in the non-pregnant state,

in pregnancy, in labour, and toxaemia. The following table, while not claiming to be an accurate guide to the condition, will serve as a help to the physician.

Toxaemias.

In the non-pregnant, with excretion of 14–18 grammes of *urinary* nitrogen per day, total nitrogen excretion is :

	Non-pregnant.	Pregnant.	Labour.	Toxaemias.
Urea.	85–89%	Decreased.	Still less, 50%.	30%, about.
Ammonia.	3–6%	Increased.	More so, 10%.	More still.
Creatinin.	3	Varies.	?	?
Uric acid.	7%	?	?	?
Amino acids.	3–8%	Increased.	Much increased, 20–30%.	Rises more.

Blood Urea.

Non-Pregnant . 30–45 mgms. per 100 c.c.
Pregnant . . Less.
Toxaemias . . Above 50 mgms. per 100 c.c. (kidneys inefficient).

THE SPECIAL TOXAEMIAS

HYPEREMESIS GRAVIDARUM. THE PERNICIOUS VOMITING OF PREGNANCY

Varieties :

(1) Neurotic.
(2) Reflex.
(3) Toxaemic.

The **Neurotic** type is very real, and we have met many instances of it. The **Reflex** type may be associated with backward displacement of the uterus, erosion of the cervix, and too firm attachment of the membranes around the internal os. We are *rather sceptical* about these reflex causes, and believe they are really of the neurotic type. If, however, any of them are present, it will do no harm to correct them, and if retroflexion is present, it should be replaced and a pessary inserted. Erosion should be treated by local applications.

For the cure of the too adherent membranes it has been suggested to dilate up the cervix with the finger and to separate the membranes in the neighbourhood of the os internum. This procedure should not be undertaken light-heartedly, and should only be resorted to when all other means, short of emptying the uterus, have been tried. By curing such trifling complaints as may be present the hyperemesis may be stopped.

Diagnosis, symptoms, and signs. The diagnosis of hysterical from toxaemic vomiting is extremely important and sometimes difficult. Theoretically speaking, in the former the patient has none of the signs or symptoms of toxaemia; she has a clean tongue, no albuminuria, sleeps well, and responds to anti-hysterical treatment. Lately we had at the Rotunda a young woman with clear complexion, clean tongue, normal temperature and pulse, no albuminuria. A diagnosis of hysterical vomiting was made, and appropriate treatment was carried out. She answered to the treatment. The routine tests were made, and it was found that the Fouchet test and the other hepatic function tests were positive for toxaemia: the blood urea was 112 mgms. per cent. It was thought the laboratory was wrong: the day after the results of the test were received the patient became violently ill, and induction was necessary to save her life. This case showed the help of the laboratory, and the necessity for taking great care to exclude toxaemia even in the most obvious hysterical case, but, as stated already, clinical tests are as a rule more satisfactory than biochemical results.

The patient with hyperemesis may vomit nearly continuously, the interference with the liver being shown by the coffee-ground vomit.

It may occur any hour of the day or night, and headache, constipation, insomnia, pruritus, irritability may be accompaniments. The patient loses flesh, and begins to suffer pain from the vomiting. Later, more severe signs of toxaemia arise, with rise of temperature and pulse. The pulse is feeble and rapid. She has intense thirst, her tongue becomes dry and brown, her gums covered with sordes, her breath foetid, and she may have diarrhoea. Her urine is scanty,

dark-coloured, and contains albumin, acetone, diacetic acid, and perhaps blood. She becomes delirious, and eventually dies in coma.

Sometimes abortion occurs. Abortion may kill an exhausted woman by the shock of labour, or by puerperal sepsis. But if it does not kill her, her condition will probably greatly improve. The significance of these facts on treatment is clear.

Generally speaking, the diagnosis of toxaemia is a simple matter, and the case described above is the exception. That is, the hysterical is diagnosed from the toxaemic type by the absence of all toxaemic signs.

A routine biochemical examination should be made in every case, and if the Fouchet test is positive, and the blood urea is above about 70 mgms. per cent., hysteria may usually be ruled out.

Treatment. When hysterical, do not tell the patient so. Inform her she will soon be well, that she is not to vomit any more; take all basins, etc., away. Put her on a full diet without grease. In many instances she will get quite well. Fly blisters, spraying the stomach with aether or the use of the electric battery may be tried.

Drugs as recommended for the toxaemic cases may be given. *If the case be toxaemic*, it must be treated on toxaemic principles: elimination of food products and dilution of toxins. She should be put to bed. If she is able to take calomel, give it, one grain every hour, until the bowels move; if not, wash out her stomach, and leave in three ounces of mist. sennae co. Wash out the colon in a severe case; a high enema suffices in a milder case. The stomach and colon lavage should be repeated if conditions do not improve, the former twice daily, the latter three or four times daily, if the result is not satisfactory. If urine is not being secreted, or is very scanty, apply linseed poultices to the loins, and give saline solution under the breasts. The latter may be repeated, and is given two pints at a time.

Decapsulation of the kidney has been suggested as a treatment for anuria, but we have never found it necessary, and rely on eliminative treatment.

Glucose is nowadays a favourite remedy for all toxaemias.

When the patient can take it she gets ʒij in water flavoured with lemon-juice every four hours. Or else she gets it by the rectum (℥ij to the pint) with sodium bicarbonate solution. The latter is a rational form of treatment for acidosis. Glucose can also be given, and is best absorbed intravenously; it is absorbed quickly and has successfully accounted for the lack of glycogen in the liver in some of our cases. We usually give it in a 10 per cent. solution, but the strength may be 20 to 25 per cent. One pint is allowed to flow by gravity into the veins at a very slow rate, taking half an hour to inject. If it is given quickly, the result is disastrous, and severe shock, sometimes with a type of diabetic coma, may follow. Glucose solution may be given as an alternative into the subcutaneous tissues.

Insulin 5 to 10 units is sometimes injected simultaneously, and it should always be ready in case of emergency, that is, if coma follows the injection. Corpus luteum gr. ½ injected intravenously or intramuscularly twice a day has given good results. The injection of 5 c.c. of the blood of a woman pregnant about the same period is sometimes effective. It should be repeated daily for two or three days.

These cases are sometimes intractable, and induction of labour may be necessary. When the patient improves, the bowels must be kept free. The starvation must be gradually replaced by whey, and later by milk very diluted with water. After a few days a cup of tea, with bread and butter, may be given as a precursor to a more extensive diet.

When should induction be done? If, in spite of treatment, vomiting continues, the pulse rate becomes weaker and more rapid, the amount of albumin remains unaltered, and biochemical reactions remain positive. The general appearance of the patient aids enormously—the pinched haunted look with a slight icterus will decide on induction in doubtful cases. A pulse rate persistently over 100 is taken as an indication for induction when other symptoms are present.

How to empty the uterus. Apart from some cases where it is necessary to empty the uterus quickly, the method of choice is the insertion of sea-tangle tents. In twenty-four hours this will dilate the cervix enough to turn and bring down a foot, or to remove the ovum in some

other way (see p. 237). In case of extreme urgency the uterus should be emptied after splitting the cervix and pushing up the bladder (minor vaginal Caesarean section).

POST-MORTEM CHANGES

These cases are seldom fatal, so that post-mortem results are difficult to see. In the liver there is marked necrosis of the central part of the lobules, while the periphery remains intact; there is marked fatty degeneration. In the kidney the epithelium of the convoluted tubules is necrotic and the lumina are filled with débris.

It is interesting to note that the appearance in the liver of pernicious vomiting is different from that found in eclampsia, for the involvement in the latter begins in the peri-portal region, and is due to thrombosis.

ALBUMINURIA, ECLAMPSISM OR PRE-ECLAMPSIA, ECLAMPSIA

Albuminuria. Under this heading must be included those women who become pregnant when suffering from nephritis, as well as those who develop albuminuria after pregnancy.

In these days, when antenatal supervision is practised in every country, many cases of albuminuria which became eclampsia in the past are saved from this fate, in consequence of which it is difficult to compare eclamptic statistics of the past with those of the present. In other words, many mild cases of eclampsia of fifteen to twenty years ago would rank as albuminuria in the present day.

The differential diagnosis of chronic nephritis and the albuminuria of pregnancy may present much difficulty, but as both the treatment and prognosis are much the same, the difference is not of great moment. At the same time it is more likely that a true nephritic case will progress to accidental haemorrhage, and a toxaemic case to eclampsia, while the prognosis as to ultimate healing of the kidneys is more likely in the case of toxaemia than in the case of nephritis. From an academic standpoint the diagnosis is of interest, and the following table gives a clue to correct diagnosis.

Nephritis.	*Albuminuria of Pregnancy.*
History of scarlatina, diphtheria, measles, etc.	None.
Albuminuria, oedema, early	Late.
Oedema : face and upper extremities	Chiefly lower.
History of *intercurrent* attacks	None.
Acute *exacerbation* of nephritis may occur	
Prognosis for ultimate healing of kidneys, bad	Good.
Renal efficiency tests useless in differential diagnosis.	
Defect in urea-excretory power less marked	More marked.
Low diastase value of urine	Normal.

The necessity for testing the urine regularly is agreed upon by everyone in the present day. It should be done from the early months : for in this way nephritis previous to pregnancy may be diagnosed. The albuminuria of pregnancy does not appear as a rule until the sixth or seventh month, when it may be scanty or great in amount. Its importance is that it is evidence of a toxaemic condition, whereby it may produce swelling of the legs, puffiness under the eyes, swollen labia, and optic atrophy; that it is very likely to lead to intra-uterine death of the foetus, or to premature labour; and, lastly, that it may precede eclampsia. Like all other toxic diseases of pregnancy, it is more common in primigravidae than in multiparae.

Albuminuria may be of varying degrees. At the Rotunda we divide it into—

(1) Faint trace.
(2) Present.
(3) Abundant.
(4) Solid.

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This method of classifying cases of the disease is more practical than by estimating the exact amount of albumin, for there is no absolutely accurate way of doing this. The first warns us of danger, the second that danger is present. When the albumin is abundant, that is, when the amount is great without being absolutely solid, there are usually symptoms suggestive of eclampsia. When the amount of albumin is so great that it boils practically solid, all the symptoms of eclampsia will be present without fits, and the condition is known as **Eclampsism** or **Pre-eclampsia.** The treatment of all these varies with the degree of disease. In a severe case all the treatment which is recommended for eclampsia must be carried out.

Treatment. In order to decide on treatment the symptoms and signs must be carefully studied. In addition to the ordinary test for albumin, the amount should be gauged in an Esbach's albuminometer, although present-day knowledge points to the fact that this estimation is not always absolutely accurate. The blood pressure should be taken. If necessary, the urinary and blood urea estimates should be made. Moreover, if there is any doubt as to the diagnosis for deficient metabolism, Fouchet's test should be carried out. *The case is best followed by observing the clinical manifestations, the test for albumin and the amount of urine secreted : these are the most important factors.*

The patient with scanty albumin and a fairly normal blood pressure responds readily to treatment. *If the amount of albumin is great, if the secretion of urine is small approximating to none, if the blood pressure is between* 180 *and* 200 *and the blood urea is* 100 *mgms. per cent., the prognosis is bad with regard to carrying on the pregnancy.*

The patient is put on water, and is encouraged to drink four or five pints in the day. Her bowels are kept free by purgatives, and high enemas are given. Colon lavage may be done. Mist. sennae co. ℥iij, castor oil ℥ij and pulv. jalapae co. ʒjss are useful purgatives. If she vomits, the stomach should be washed out and a purgative left in. We now give glucose in water flavoured with lemon-juice, four or five times daily, by the mouth. If she cannot retain it, we give it with sodium bicarbonate by the bowel. If she is very ill, a solution of 10 per cent. glucose is given intravenously. When the urine becomes scanty, and fluids are not being assimilated, two pints of a solution of sodium bicarbonate ʒj to the pint are injected under the breasts. In very selected cases of high blood pressure with anuria and headache we withdraw 10 oz. of blood. In some cases it is necessary to induce labour, and if possible we prefer to wait to do this unless the child is viable. When the child is viable, its life and that of the mother may be saved by induction at the proper time.

When should induction be done in cases of albuminuria (Eclampsism) ?

(1) If, in spite of treatment, the quantity of albumin does not lessen after four days starvation : if starvation is

persisted in too long, a condition of hypoglycaemia may occur. This is the readiest and best clinical test.

(2) If, in spite of all treatment, the urine is scanty or practically nil, with 4 or 5 grammes of albumin per litre and a blood pressure persisting at 200. If these symptoms are accompanied by optic neuritis, induction is imperative.

The *best method* is by bougies. Puncture of the membranes may be tried in some cases. If the case is extremely urgent, Caesarean section may be considered, but is seldom necessary.

Very often the albuminuria clears up nearly entirely, and the patient is able to go to term.

Future prognosis. Once a woman has had albuminuria in pregnancy it may (1) not clear up at all; (2) it may clear up in any time from a week after confinement to a year.

A woman who has had albuminuria of pregnancy should not become pregnant again until the urine is absolutely clear. When she does, she is liable to a recurrence.

In spite of all care, the patient may develop eclampsia, or she may have developed it before she is seen by the obstetrician.

ECLAMPSIA

What is eclampsia? We define eclampsia as the occurrence of fits in a pregnant or puerperal woman which would not have occurred if she had not been pregnant.

Some authorities regard a true pre-eclampsia or eclampsism as eclampsia without fits. In this edition, however, we shall not adopt this attitude, and we shall still have "fits" as our determining factor in the nomenclature "eclampsia." In other words, from a practical point of view it is inconvenient to dissociate the name of the disease from its most common symptom. Were this done now it would be impossible to compile statistics with any degree of accuracy. Many women suffer from toxic processes during pregnancy, and if all such were classed as eclamptics, the word would lose its special significance. For this reason we consider the occurrence of fits essential in the diagnosis of eclampsia. We do not consider patients eclamptic who recover from fits, and who, at the same time, have no

albumin in their urine. We do not consider fits eclamptic if they occur before the sixth month of pregnancy. Further, we exclude from the category of eclamptics all those patients who give a history of convulsive attacks apart from pregnancy. If, however, any pregnant or puerperal woman dies after an attack of convulsions she is considered eclamptic, unless the post-mortem examination points very definitely to the presence of some other cause.

When does eclampsia occur ? Eclampsia does not occur before the sixth lunar month of pregnancy. Its incidence becomes more frequent as the pregnancy approaches to full term. It may, however, show itself for the first time up to five days after delivery. It is most common during the last two or three months of pregnancy.

Danger of eclampsia. Eclampsia is always a grave disease. It is most serious when it occurs during labour. Its occurrence during the puerperium is somewhat less serious than during labour. When it occurs without the onset of labour it is least dangerous. This has been our experience at the Rotunda Hospital. General statistics show that the average maternal mortality ranges between 20 and 30 per cent. of those attacked. In our last investigation our mortality rate was 8 per cent.

Some notable facts connected with eclampsia.

1. Like other diseases due to a toxaemia, eclampsia is more common in primigravidae than in multiparae.

2. It is relatively more common in twin pregnancy than when a single child is present.

3. In this country it is more apt to occur when the weather is cold and damp, although in hot countries the disease is more common than in those with a temperate climate. This, perhaps, is connected with an insufficient consumption of water by the patient. The disease seems to occur in epidemics, a fact which suggests a bacterial agent in its causation.

4. The death of the child in utero, or its birth, as a rule—but not always, greatly improves the condition of the mother.

5. Albuminuria almost always precedes a fit, and is always present after a fit.

6. The more numerous the fits the greater the danger to both mother and child.

7. The patient may die after a few fits, or recovery may take place after more than thirty fits.

8. If the patient recovers, the kidney disease gets well, and, as a rule, it does not recur in subsequent pregnancies.

9. Rupture of the membranes is occasionally followed by an improvement in the condition of the patient. This is probably due to the loss of the liquor amnii.

Pathology. The pathological findings in eclampsia are

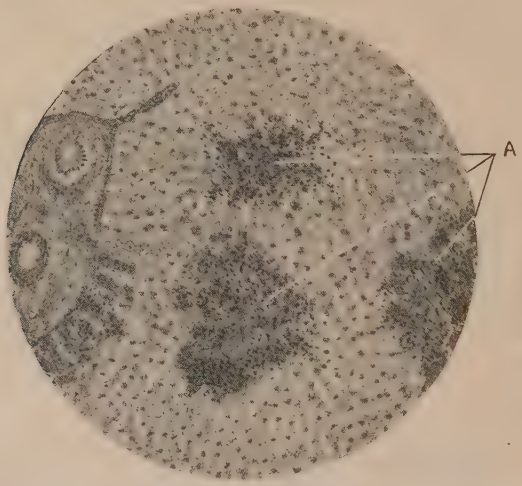


Fig. 108.—Liver section from case of eclampsia. (Rotunda specimen.) A, zones of haemorrhage.

so characteristic that they leave no doubt as to the nature of the illness. The liver, kidneys, spleen, brain, and heart are all involved.

Liver. This organ (see Fig. 108) is enlarged and is studded throughout with patchy haemorrhages of varying size which are visible to the naked eye. Areas of focal necrosis are found in the periphery of the lobule, and there is considerable cloudy swelling of the liver cells generally. As to the cause of the necrosis nothing certain is known. Some attribute it to syncytial masses which have been swept into the portal veins, whilst others maintain it to be due to toxins whose origin has already been discussed.

The areas of haemorrhage are to be found in the peri-portal region of the lobule.

A microscopic section of a liver removed at post-mortem from a case of eclampsia is shown in which the haemorrhages can be seen; also the cloudy swelling and fatty degeneration of some of the lower cells typified by lack of nuclear stain.

Kidneys. The kidneys are acutely inflamed, and closely resemble the kidney in the nephritis of scarlatina. They are large, soft, and congested. The capsule peels off easily, and the glomeruli and tubules are thickly packed with blood and epithelial casts. The epithelium of the tubules is in a condition of cloudy swelling. This kidney is sometimes known as the "kidney of pregnancy." This name is also applied to the kidney in a less advanced condition of inflammation, where there is degeneration without the acute congestion.

The brain is much congested in some parts, in others it shows great anaemia. The anaemia has been held to account for the onset of the fits, and possibly it may be so. There are small haemorrhages scattered through the brain substance, and sometimes a large effusion of blood is found. The spleen is large, soft, and much congested. The heart muscle is softened, tears easily, and at time undergoes fatty degeneration.

Extravasations of blood into the lungs, stomach, or peritoneal cavity sometimes take place, and may be a cause of death. A diminution in the fluidity of the blood has been observed as well as thrombosis in the veins. The thyroid gland, which normally should hypertrophy during pregnancy, has been found deficient in growth.

On summing up the autopsy findings it is found that the liver and kidneys are the organs most consistently involved.

The positive tests for liver malfunction which are obtained are borne out to a large extent by these post-mortem findings.

Aetiology. This has been discussed to a great extent in the opening chapter on toxaemia, but in the special case of eclampsia other theories of the disease must be mentioned to be condemned.

We shall not go further into the two main theories we have already expounded (see p. 191), and we shall only mention the others and say that we do not believe we can ever theorise with success on any of them, except the two already mentioned.

(1) Bacteria. There have been as many bacteria discovered as the cause of eclampsia as for cancer: we must neglect this theory.

(2) Accumulation of toxic substances in the blood serum, causing an auto-intoxication.

(3) Anaphylaxis.

(4) Toxaemia arising in the breasts. This ridiculous theory of Sellheim has been abandoned for many years.

(5) Disturbed metabolism.

(6) Diminution of calcium content in the blood.

(7) Disturbance in the ductless gland system. Needless to say, many investigators have endeavoured without effect to attribute eclampsia to the endocrine system.

Warning signs and symptoms of eclampsia. Every sign and symptom of toxaemia, occurring after the end of the fifth month of pregnancy, must be regarded as an indication that an attack of eclampsia is likely to occur. The patient may complain of headache, vertigo, flashes of light before her eyes, partial or total blindness, pruritus, drowsiness, mental irritability, insomnia, constipation, oedema of legs, puffiness under the eyes, and a diminution in the quantity of urine passed. If the urine is examined albuminuria will usually be found.

Significance of warning signs and symptoms. It is impossible to attach too much importance to the warning signs and symptoms of eclampsia. Their early recognition may enable us to ward off an attack of a disease that is attended at the best with a death-rate of 8 per cent. If a patient, in the later months of pregnancy, complains of any of the premonitory symptoms of eclampsia her urine should be examined at once for albumin. If that condition is found to be present, there should be no delay in undertaking suitable treatment.

The eclamptic fit. The eclamptic fit closely resembles that of epilepsy, and, like it, starts with a tonic convulsion.

The patient, with or without an aura, suddenly becomes unconscious and stiff, and if she is standing, falls heavily to the ground. There is no cry as in epilepsy, but all her muscles become rigid with tonic contraction. Her face is red and congested, her hands are clenched, her jaws locked (sometimes biting her tongue), her chest is fixed, her arms are bent, and her back is stiff, but rarely arched. In all these phenomena the fits of eclampsia and epilepsy closely resemble each other; they differ, however, in their duration. In eclampsia this tonic stage of the fit is so brief that it may easily pass unnoticed, whereas in epilepsy it lasts several seconds, and the appearance of the patient is vividly impressed on the minds of the onlookers. In addition there will be a history of epilepsy.

The tonic contraction which characterises the onset of the fit then gives place to clonic convulsions. This clonic stage does not differ from the clonic convulsions of an epileptic fit. The muscles that were stiff twitch or jerk. The face twitches, the breath comes in fits and starts, the arms may be jerked about violently, but the legs usually remain still. This stage lasts from one to two minutes, and during it the patient may die. If she survives, the clonic convulsions pass away, leaving her in a condition of coma. In this, the last stage of the fit, the muscles relax, and the patient lies comatose, with heavy stertorous breathing. Whilst the attack lasts the woman is quite unconscious, and her eye reflexes are completely absent. During the fit the face is often much swollen and congested, and there is a collection of frothy mucus in the mouth and air passages, which obstructs respiration. While comatose the patient may respond to a painful stimulus, and will resist the passage of a stomach tube. Frequently she passes her hand over her nose, apparently trying to relieve a sensation of itchiness.

Events following the fit. The patient may pass from the condition of coma into a deep sleep, from which she wakens with headache and some mental confusion. She may recover, without any return of the fits; or after an interval she may again be convulsed, and again recover. Sometimes the fits recur without any interval of recovery,

and recurrent convulsions may follow in rapid succession. With each recurrence the danger to the patient's life is increased. Deep and prolonged coma, a rising temperature, and a rapid pulse of low tension, all indicate the gravest danger. Coarse râles may be heard over the chest. These are due to oedema of the lungs, a condition that commonly precedes death in this disease, as it does in acute nephritis, and in all toxaemic conditions. The fits may cease many hours before death; but the deep coma remains, and the heart, overwhelmed by the poison, becomes weaker and weaker till it finally ceases to beat. Eclampsia frequently leads to the onset of labour; and sometimes the onset of labour induces eclampsia, so that in every case the birth of the child should be expected. Restlessness on the part of the patient often is a warning of the onset of labour. This can be diagnosed by placing the hand on the abdomen, when a contraction will be felt.

Differential diagnosis. Hysterical fits, and the fits due to cerebral lesions, are readily distinguished from those of eclampsia. Uraemic fits, occurring during the last months of pregnancy, are practically indistinguishable from those of eclampsia at the time of their occurrence. Epileptic fits must be differentiated from eclamptic by the duration of the initial, or tonic stage, and by the history of the patient. Epilepsy is often present without albuminuria. In tropical countries convulsions accompanied by a high temperature may be due to heat-stroke and not to eclampsia. Such convulsions are rarely associated with albuminuria. A single convulsion sometimes occurs in a woman dying from sepsis, or from pernicious anaemia. If a woman is reported to have had a fit four or five days after her confinement, such causes as epilepsy should always be kept in mind. The fit may, however, be due to eclampsia; if so the cardiac symptoms will be present.

Treatment. Different methods of treatment have from time to time been advocated according to the various views held about the causation of the disease. We shall first describe in detail our own treatment, and then shall consider some of the principal points in those recommended by others. Our method of treatment has been evolved as the

result of experience in the Rotunda Hospital, where its adoption has been followed by excellent results, as shown by the statistics of the hospital. **We cannot too strongly insist on the necessity for paying the very strictest attention to every detail of this treatment.** Every part of it has been found to be essential to success, and over and over again we have seen failure follow the neglect of what appeared to others to be unimportant details.

In the stage of eclampsism. This has already been mentioned when dealing with albuminuria. If the case approximates eclampsia closely, the whole treatment for eclampsia as given below must be carried out.

In the eclamptic stage.

Nursing. This is a most important part of the treatment, and we have saved more lives by carefully watching our patients than by any other means. It is the duty of the practitioner to direct the nurse exactly what she is to do in case of fits. In the Rotunda it has been our custom to ask for volunteers among the doctors to look after the patients for two hours at a time. The main way in which the attendant can help is when the patient is drowning in mucus. During a fit the mucus pours out of her mouth like water from a tap, and unless the woman is hastily brought over to the edge of the bed, with her mouth towards the floor, the tongue brought forward, the mucus removed from the mouth and back of the throat, she will surely die. In addition it may be necessary to perform artificial respiration, and oxygen will help to save the life.

Immediately it is discovered that eclampsia is present, she is put in a quiet room and given *morphine*. The room must not be dark, for the patient must be very visible. She is put lying on her *right side*. The side is chosen so that the large amount of mucus which collects in these cases may drain down out of the side of her mouth, and not into her larynx: the right side is chosen to avoid pressure on the heart. A gag is ready, and something to prevent her from biting her tongue: we usually use the handle of a spoon with a piece of lint sewn around it.

In addition a bullet forceps to pull the tongue forward in case it fall backwards is a necessity. A hypodermic syringe with necessary tablets, etc. should be ready sterilised.

If she is conscious. She is given mist. sennae co. ℥iij; the morphine treatment is started, colon lavage, gastric lavage, submammary infusion if necessary. Plenty of water is given.

If she is unconscious. The same treatment is carried out, except that the patient cannot take water, nor can a purge be administered.

Details and consideration of the treatment as carried out at the Rotunda Hospital will now be given.

Morphine. We are firm believers in morphine in the treatment of eclampsia. Recent investigations have confirmed us in this belief. Anything which raises the CO_2 combining power of the blood is beneficial, and morphine is an effective agent in doing this without damaging the liver. It controls the fits, and as it has been proved that the prognosis in eclampsia depends to a large extent on the number of fits, anything which keeps the number down is of service. Its great disadvantage is its effect on respiration. We have seen the rate go down to four a minute: this should not happen: if it does, it is combated by the administration of atropine gr. $\frac{1}{100}$, and by inhalation of oxygen.

Our routine consists of half a grain with the first fit, and a quarter of a grain with each fit, *up to two grains in the twenty-four hours*, but two hours must elapse between each dose, that is, if the first dose is at six, the next not to be before eight, the next ten, and so on.

If the respirations become slow, atropine gr. $\frac{1}{100}$ is given with the morphine: if the rate goes below nine to the minute, stop the morphine and give atropine alone, with, if necessary, oxygen.

Poultices to the loins. These are applied to assist in secretion of urine: there is no doubt they help. They should be renewed every two hours. They should be hot, but not too hot, for the skin of the toxaemic patient is highly sensitive to heat.

Colon lavage. The patient is turned on to her left side, and a long, soft rubber tube, lubricated with glycerine, is pushed through the anus high up into the rectum. We pass twelve inches of the tube into the rectum, for the higher the tube passes the more of the bowel is cleansed. If one allows water to flow through the tube while it is being passed it makes its progress easier, as the flowing water opens the lumen of the bowel. The bowel is washed out with warm water, precisely as the stomach was washed out, using a pint of water at a time, and continuing the washing till the faeces stain the return flow. The process is tedious, and it may take from half to one hour before any sign of faeces is seen in the water returning from the bowel.

The tube is inclined to become kinked, and if the fluid is not flowing, and is inclined to return by the side of the tube, the latter being twelve inches up in the rectum, a finger should then be passed up alongside the tube to ensure it going past the second part of the rectum. The finger is not passed unless absolutely necessary, for it causes some shock to the patient.

Colon lavage is repeated three or four times daily in a severe case. If the first result is not satisfactory, and the bowels do not move again in three or four hours, the lavage must be repeated. A good general rule to follow is—unless the bowels are moving satisfactorily from four to six times daily, repeat the lavage. Also, if urine is not being secreted, repeat the lavage, as the toxaemic condition is preventing the kidneys from acting.

Gastric lavage. This is done when the patient is vomiting, or when she is so unconscious that the only means of giving a purgative is by the tube. The gastric lavage should be repeated if the vomiting does not stop, or if she is still unconscious and it is necessary to get purgatives into the stomach. It is well that she should be a little under the influence of morphine before passing the tube, but this is not a necessity. It is inserted as follows : The stomach tube should be lubricated with glycerine, or with warm water. The patient's mouth must be kept open by a gag placed between her jaws, and a finger is passed

well to the back of her tongue. The tube is quickly inserted into the oesophagus, being guided into position by the finger in the mouth. The stomach is washed out with warm water. A pint of warm water is poured into the funnel of the tube, which is then lowered over a bath on the floor, and the fluid allowed to flow out by siphon action. This washing out is continued until the fluid returns quite clear from the stomach. We used to leave about a pint of fluid in the stomach, but we have practically discontinued it for fear of the fluid pressing on the diaphragm and causing cardiac dilatation.

Before withdrawing the tube, we introduce into the stomach three or four ounces of mist. sennae co. or two ounces of castor oil, we then pour down two or three more ounces of the sodium bicarbonate solution. Then we wait for a few minutes, after which we withdraw the tube quickly and quietly.

Castor oil is so viscid that it does not pass readily down the tube. One can make it run in by pouring a little hot water on top of it, and then squeezing the tube between the finger and thumb from the funnel downwards as the tube is withdrawn.

Submammary infusion. If the patient is not improving, if her pulse is weak and thready, if there is insufficient secretion of urine, sodium bicarbonate solution 1 drachm to the pint is infused under each breast. This is an important part of the treatment.

The temperature of the fluid should be between 110° and 115° F., and the strictest aseptic precautions should be taken, otherwise extensive infection and sloughing of the parts may follow. It should be repeated if the symptoms do not improve.

Glucose, as already stated, is useful in all toxaemias, for most of the patients are suffering from acidosis. We give it to eclamptics in the same way as to other sufferers.

Our method of sterilising it is given in the Appendix (see p. 731).

Treatment with regard to the birth of the child. If the patient recovers from eclampsia and is near term, it is well to induce labour when she is well over the fits.

For example, a woman between thirty-six and forty weeks pregnant recovers from eclampsia, but the albumin does not disappear altogether from the urine; it is wise then to induce labour, for she cannot be kept on starvation treatment indefinitely.

If she is about seven months pregnant, she should be observed carefully and allowed to go to term.

Most patients fall into labour during eclampsia, and the strength of the toxin usually kills the child.

Labour should be terminated when all conditions which allow immediate delivery are fulfilled. That is, when the patient is in the second stage and termination of the labour will not be a shock to her.

Anaesthetics. Chloroform must not be used: it causes the same destruction to the liver and other organs as the eclamptic poison, besides which, it may cause syncope.

Open ether is the anaesthetic we use when necessary. We do not agree with those observers who give chloroform for manipulations such as catheterisation: the danger of the anaesthetic is greater than the danger of fits being started by the manipulations.

Caesarean section is scarcely ever indicated in our practice. In the event of a patient remaining for three or four days in a severe eclamptic condition without improvement, section might be considered; but we have not met a case for many years in which section was indicated.

Some of the treatments that have been recommended.

Stroganoff's. His treatment is somewhat similar to ours, in that it is palliative instead of radical. He has had excellent results. At the British Congress of Gynaecology and Obstetrics held in 1922, we produced the results of 204 cases with a mortality of little over 8 per cent. In view of the results at the Rotunda and those obtained by Stroganoff, the radical treatment of eclampsia has been given up in most clinics. Stroganoff gives chloral: we do not like it because it is a heart depressant.

Venesection. We have used venesection, but we do not use it as a routine: in fact we reserve it for the rare case of nearly complete suppression of urine with severe headache,

when we remove ten ounces of blood, otherwise we find it depresses the heart; and as failure of the circulation is one of the most fatal symptoms of the disease, we seldom practise it.

Sweating. Some depend chiefly on the excretion of the skin as a means of getting rid of the poison in eclampsia. The skin, however, is a poor excretory organ, and the production of diaphoresis is often followed by profound circulatory depression. We do not recommend sweating for our patients.

Drugs for the reduction of blood pressure. Veratrone is the chief of these, and good results have been obtained. We do not like, however, to see a sudden drop: in fact we regard it as a bad omen, and although we have used veratrone occasionally in the past, its use has been discontinued. We feel, too, that the use of a drug such as this by the unskilled may cloak the necessity for great attention to the detail necessary in our method of treatment.

ACUTE YELLOW ATROPHY (*Icterus gravis*)

This is liable to be confused with the pre-eclamptic and eclamptic stage, but it differs from the latter in both pathological and clinical respects.

Varieties. It may occur in pregnancy or the puerperium.

Aetiology. The cause of this very fatal disease is not known. When it happens in the puerperium it is sometimes difficult to diagnose it from sepsis, and we believe that some reported cases were really due to sepsis. Various causal factors have been suggested: delayed chloroform poisoning, syphilis, cirrhosis of the liver, are some of the probabilities.

Pathology. The liver is the chief seat of involvement. It rapidly diminishes in size and weight, becomes soft, red and bile-stained. Its capsule is much wrinkled, and it has a greasy feel.

The centre of each lobule is stained with bile pigment, whilst the periphery is often converted into a granular mass of débris, with a few cells of normal appearance still surviving at its edge.

The kidneys present the appearance of acute nephritis, and the epithelial cells are seen in all shapes of degeneration.

Symptoms. The onset is insidious, and is usually preceded by serious disinclination to drink water, by a dry skin, by constipation, obstinate vomiting, and a yellow tinge in the conjunctiva. This latter is a symptom of great importance, and should at once excite suspicion.

The vomiting increases in severity, and the patient becomes irritable and difficult to manage. Violent delirium supervenes, which is followed by coma, convulsions, and death.

The course of the disease in pregnancy suggests pre-eclampsia, and the onset of convulsions helps to confirm this possible mistake.

The urine is scanty, high-coloured, containing albumin and many casts. The urea is diminished. There is a diminution in amino acids, and leucin and tyrosin are also present; these when found help to distinguish the disease from phosphorus poisoning, to which it has many resemblances.

Prognosis. The prognosis is bad, and when once the disease becomes well established it is probably always fatal.

Diagnosis. Vomiting, yellow conjunctiva, diminished area of hepatic dullness, and noisy delirium, with the presence of leucin and tyrosin in the urine, should serve to differentiate the disease from other toxaemias.

Treatment must be conducted on similar lines to that of other forms of toxaemia.

Speedy emptying of the uterus should be done in pregnancy, and Caesarean section is the choice. Intravenous glucose should be given as already described for the toxaemias.

EPISTAXIS, ETC.

Haemorrhages from such regions as the nose or stomach are liable to occur during pregnancy as a symptom of a general toxaemia. They may also occur without any other toxaemic signs or symptoms. Pregnant women may vomit blood as a result of gastric or duodenal ulcer, or malignant disease, or the blood may have been swallowed first, as in the case of epistaxis.

We have met with three very nearly fatal cases of epistaxis in pregnancy. It occurs at any stage of preg-

nancy, and the normal vascular condition of the nose is enormously increased. The patient may die from haemorrhage, or she may get so collapsed that she may require energetic treatment before recovery ensues.

Treatment. This should be on toxaemic lines. The bleeding must be stopped, and it is sometimes necessary to call in the aid of a rhinologist to plug the anterior and posterior nares. Such substances as adrenaline chloride, horse serum and collosal calcium should be administered.

It may be necessary to empty the uterus. If, having plugged the nares, the bleeding persists after removal of the plug, the uterus must be emptied. If it is not extremely urgent, induction by means of tents or bougies should be done. Usually it is a matter of urgency, and removal by the abdomen is the best procedure. Treatment for collapse should be carried out.

HERPES GESTATIONIS

This is a rare disease of pregnancy and usually occurs in the latter months. The skin becomes irritable, itchy and painful; the leg or thigh is most usually affected and becomes covered with an herpetic and desquamating rash: the face is sometimes involved. The condition usually lasts till some days after childbirth, and is liable to return in subsequent pregnancy, and is a source of great discomfort and danger. It is often associated with some debilitating disease such as phthisis.

Treatment. The application of 10 per cent. ichthyol in glycerine is a very effective treatment; sometimes, however, a powder containing equal quantities of starch and lycopodium powder is more effective. The condition is considered to be in the nature of an anaphylactic reaction, and the following treatment has produced a cure in many instances. Ten c.c. of blood are extracted from the vein of a woman at the same stage of pregnancy, and its serum portion is injected into the vein of the patient it is required to treat. The dose is to be repeated every fourth day, until eight to ten doses have been given. Horse serum has been suggested to take the place of that of the human subject, and subcutaneous injections have been substituted

instead of intravenous. The general treatment for toxaemia should be carried out.

SALIVATION

Salivation is an undoubted symptom of toxaemia. It is not in itself dangerous, but causes the greatest distress. The patient, who is usually highly strung and of a nervous temperament, is reduced to a condition of the utmost discomfort by the pouring of saliva into her pocket-handkerchief, which she has constantly to carry about with her. The salivation is often accompanied by a peculiarly unpleasant sweetish taste in the mouth. It is rarely present during sleep, but is particularly severe before food and on lying down at night.

Treatment. Complete abstinence from food for a period of forty-eight hours will almost certainly cure the condition. During this time plenty of water made slightly alkaline by bicarbonate of soda may be administered. The bowels should be kept free and the patient be confined to bed, the handkerchief and towels taken from her, and the advice given to swallow the saliva rather than void it from the mouth. When once the condition has been cured it seldom returns, and pregnancy proceeds normally.

Tincture of belladonna in 5-minim doses three times daily has been found of use. Atropine sulphate gr. $\frac{1}{100}$ is also valuable.

CRAVINGS

An altered taste for food is amongst the most common features of pregnancy, and the desire for certain indigestible substances may be pronounced. Apples with their skins, orange and lemon pulp, raw starch, salt, raw vegetables, uncooked oaten meal, comprise fair samples of the substances for which the woman craves. The craving is frequently noted amongst pre-eclamptic patients, and persistence in it greatly aggravates the condition.

Treatment. It is safe to assume that all such cravings are deleterious, and that the substance so much desired is harmful, and its use must be discontinued. Self-control, combined with strict attention to the digestive functions,

will enable the woman quickly to overcome her unusual longings.

HYDRAEMIA

The condition of hydraemia is due to the toxaemia of pregnancy, but its connection with the food intake does not appear so evident as in other toxaemias. It produces oedema of the legs and vulva similar to that which sometimes appears with albuminuria. There is, however, no albumin in the urine.

Signs and Symptoms. It occurs late in pregnancy. The oedema may be very great, and the labia swell to such a size that the patient cannot walk, and the stretched skin may even slough. If labour comes on the oedematous tissues may be badly torn.

Treatment. The treatment is to attend to the usual hygiene of the patient whenever slight oedema of the legs appears. Examine her urine, keep her bowels open once or twice a day, attend to her appetite, let her drink water and let her take some exercise, unless this increases the oedema of the legs. Fresh air and good food are essential. Give her an iron tonic, or malt and iron, three times a day. The avoidance of food that contains salt diminishes oedema. If the oedema is more advanced, the patient should be kept in bed also. Should the labia become very swollen, wash the stretched skin carefully and lightly with soap and water, and prick through the skin in several places with a sterile surgical needle. Clear fluid will ooze out. Cover the vulva with sterile wool, and change this when it is soaked.

The oedema quickly disappears after the birth of the child.

In one of our cases immediate improvement followed artificial rupture of the membranes and escape of unpleasantly smelling liquor amnii.

Sore gums. An astringent mouth wash containing 10 grains of alum to the ounce of water applied to the gums with a toothbrush is satisfactory.

Headache. This is usually due to constipation. It may be toxaemic, when the other symptoms of toxaemia will be

present. When not toxic a powder containing pyramidon grs. 5 and caffeine gr. j may be prescribed.

Cramps. Pregnant women not infrequently suffer from cramps in the thighs and calves. These also seem to be connected with the toxaemia of pregnancy, and must be treated accordingly. In the last month of pregnancy an additional reason for cramp is the increased pressure and congestion in the pelvis due to sinking of the child. From this form of cramp the patient is greatly relieved by lying down frequently, and by supporting the uterus with an abdominal belt (see Fig. 15).

Flatulent dyspepsia. Heartburn. These symptoms are not uncommon in pregnant women. Attention to general hygiene and the administration of a bismuth mixture may give relief. Some of the reliable antacid lozenges in the market may be suggested.

Finally, do not let the patient take too many medicines. Women are very fond of taking medicine for trifling ailments.

Morning sickness. Morning sickness is common in women between the first and fourth lunar months of pregnancy; it may continue until the end.

The patient either feels sick or actually vomits as soon as she gets out of bed in the morning. Tell her to take a meal of tea and toast before rising. This will often allay the sickness by starting peristalsis before the patient assumes the erect posture. It is very important that she should have her bowels opened daily and drink freely of water. Milk, which is given in these cases, usually increases the vomiting. Sometimes the condition is cured by putting the woman on a plain full diet, with no milk or milky foods, and no greases of any kind. If the sickness does not stop, give her light diet, and some gastric sedative, such as fifteen grains of sodium bicarbonate with twenty minims of aromatic spirits of ammonia, made up to an ounce with infusion of gentian, three times a day, half an hour before meals; or give her thirty grains of oxycarbonate of bismuth suspended in the compound tragacanth powder, or pepsencia. Complete starvation with the exception of water may be tried. If the sickness becomes troublesome, make a vaginal examination. Erosions of the cervix and uterine displacements are

said to have an influence in the causation of severe morning sickness, because with their cure the sickness sometimes ceases. Suggestion probably has a great deal to do with the relief of symptoms under these conditions.

Vomiting that makes the patient ill comes under the head of hyperemesis, and is one of the serious diseases of pregnancy (p. 195).

Varicose veins. These may be troublesome, and are more common in multiparae. Advise the patient to keep the leg raised as much as possible. The usual surgical treatment should also be followed, namely, to keep the legs bandaged, commencing from below up, and to rest with the legs elevated. She should not be allowed to stand or walk unless a crêpe bandage has been applied from the ankle to the upper part of the thigh. Otherwise elastic stockings properly fitted are the most comfortable means of support, so long as they maintain their elastic properties. Lastly, show the patient how to bandage a pad of lint or a roll of handkerchief over the vein, so that if the vein ruptures she may stop the severe haemorrhage.

In addition to the above treatment, a solution of 10 per cent. ichthyol in glycerine should be applied to the legs at night. This will probably prevent thrombosis, and is an extremely useful plan. Lint should be soaked in the solution and applied to the veins with a covering of jaconet.

Pruritus. Pruritus of the vulval region is common. It may be due to haemorrhoids, vaginal discharge, venous stasis, pediculi, diabetes, or toxaemia.

Treat the haemorrhoids as if the patient were not pregnant. Operation, however, is usually contraindicated, though it may be necessary occasionally to incise an inflamed haemorrhoid and to turn out the clot. Treat any purulent vaginitis, as it is important to get rid of purulent vaginitis before the onset of labour. The profuse leucorrhoea from which some women suffer during pregnancy is a fruitful cause of pruritus. Prescribe lead lotion (℥ss. of the liq. plumbi subacetatis fort. to the pint of water), and tell her to wash the parts night and morning with soap and water, to bathe with the lotion, and finally to dry herself and

powder with violet powder, or with a powder composed of boric acid one part, zinc oxide three parts, and starch six parts. Resinol ointment, or an ointment containing menthol or tar, is often efficient, and by its greasiness protects the parts from perpetual moisture. Ungt. cocainae (B.P.) may be prescribed as a temporary measure to stop scratching. Do not advise douching, unless the irritation is unbearable, for douching has some tendency to produce a miscarriage. Self-administered douches are seldom advisable. When necessary they are best taken with the woman lying in a warm bath, the douche-can being elevated only $1\frac{1}{2}$ to 2 feet above the level of the buttocks.

X-rays while, useful as a treatment for pruritus vulvae in the non-pregnant, are not advised where the woman is pregnant.

If the itching is mainly due to venous stasis, order sitz baths, washing with ichthyol soap, and, after drying, some ointment such as resinol. When the leucorrhoea and the pruritus have ceased, stop the treatment.

CHAPTER X

ABORTION AND MISCARRIAGE

INTRODUCTION TO ABORTION

It is well to warn the young practitioner that he should learn well the ethics of abortion. He will get frequent offers to induce him to empty the uterus, and he must remember that he risks reputation and liberty by acceptance of any of them.

It is a good rule to follow, never to induce abortion in a doubtful case without consultation with a reliable obstetrician.

Possible damage to health is not sufficient reason for induction of abortion, and the patient must be observed and treated before the serious end step is decided on.

At present, social, economic, and eugenic reasons cannot be cited as reasons for induction. As suggested at a recent discussion, resort to operative procedures is more common because of their greater safety, but this is no reason for disobeying the law and lowering the ethical standard of the profession.

Fairbairn suggests that excuses for abortion induction are similar to excuses for such so-called aberrations as kleptomania, homicide, etc. We must weigh very fully whether we are at liberty to interfere with a normal pregnancy under any condition. If loose methods arise, and other than medical reasons are allowed to obscure our vision, it will be difficult to draw a line anywhere.

The doctor who induces abortion in his own good faith, without conclusive reasons for the judge who tries him for the death of a given patient, is just as liable to the extreme penalty as the professional abortionist.

It is not possible or advisable to delve more fully into this problem here. It is sufficient to state the indications

for abortion as given on p. 237, and the inexperienced should follow these rules to the letter.

ABORTION

Haemorrhage occurring in the first three months is usually due to abortion : an abortion is due to separation of the ovum, either partial or complete. The blood usually appears at the vulva. A differential diagnosis has, however, to be made from :

(1) Tubal pregnancy.
(2) Hydatidiform mole.
(3) Carneous mole.
(4) Hydrorrhoea gravidarum.
(5) Carcinoma cervicis.
(6) Uterine polypus.

When due to abortion, the haemorrhage occurs from the separation of some part of the ovum. When the separation occurs in the second three months it is called miscarriage. Some authors deny the necessity for this differentiation, and prefer to call all bleeding until the child is viable abortion, but the practical value in the differentiation is that it reminds the student that a placenta is present once the third month has passed. This is very important, for the retention of a four-months placenta has often caused the death of a patient—had its presence been recognised, it could have been removed, and a fatal issue avoided.

Anatomy of abortion. A study of the anatomy of the structures concerned in abortion (see p. 224) will make apparent the actual abortion as it may occur. Our attention has been drawn to the illustrations of Galabin and Blacker in Eden and Holland's *Midwifery*, and they describe the sequence of events so clearly that they are reproduced here (slightly modified).

In Fig. 109 will be seen the normal arrangement. Fig. 110 shows inversion of the decidua vera, while in Fig. 111, although the capsularis has ruptured, a great part of the decidua vera, basalis and capsularis are left *in utero*. Fig. 112 demonstrates the expression of the foetus in the intact amnion. It is simple to understand that the retention

of decidua *in utero* may cause haemorrhage, and these figures demonstrate the difference between complete and incomplete abortion.

Fig. 109.—Normal anatomical arrangement in the first two months of pregnancy.

Fig. 110.—Mechanism of abortion in the early months with inversion of the decidua vera.

Fig. 111.—Mechanism of abortion in cases where the greater part of the decidua basalis, together with the decidua vera and capsularis, are left in utero.

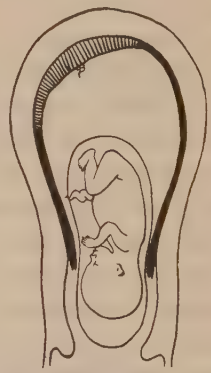


Fig. 112.—Mechanism of abortion. Foetus expelled in intact amnion.

[*By permission of E. Holland.*]

The amnion is extraordinarily elastic, and may resist for some time. Part of the chorion may remain behind when the haemorrhage continues, and radical measures may have to be employed for its removal.

Causes of abortion. The cause is sometimes obvious, at other times difficult if not impossible to ascertain. It

is necessary, therefore, to have some definite plan in mind to get to the root of the trouble. The causes of abortion may be :

CONSTITUTIONAL OR LOCAL

Constitutional.

Heart and kidney disease. Nephritis is regarded as a very common cause. The necessity for testing the urine has already been dwelt on. Even in the early months it is advisable, in order to eliminate nephritis and in order to adopt prophylactic methods if it is present. If necessary, the kidney function should be tested.

When the heart is at fault, a consultation with a reliable physician should be held to decide on appropriate treatment. The treatment of both of these will be considered later.

Syphilis. This is a fruitful cause of abortion, and a Wassermann reaction should be done as a routine : this is absolutely necessary ; the treatment of syphilis with 606 or novarsenobillon during pregnancy usually brings about the birth of a live and healthy child.

Liver diseases.

Arteriosclerosis, Gout, Lead Poisons.

Constipation. This is a fruitful and frequent cause of abortion, and the patient should be instructed to keep her bowels free. The treatment of threatened abortion, complicated by constipation, will be dealt with on p. 233.

Local. (1) **Maternal.**

In the uterus or adnexa. Inflammation, tumour of uterus or ovary (see p. 322), displacement, malformations, operations badly performed.

An inflamed endometrium prevents a firm attachment of the ovum, so that anything very slight will cause its separation.

Displacement, especially backward displacement, is one of the commonest causes, and one which can easily be corrected. Any malposition may be causal.

Ill-performed operation. In these days there should be no excuse for an abortion following a suspension operation : in the past, when ventral suspensions and fixations were in

vogue, abortion was frequent. There is now a safe operation —the subperitoneal Gilliam [1] (as practised extensively by us)—in which there is little likelihood of the occurrence of this accident.

(2) **Foetal.** Death of the ovum may cause abortion; sometimes, however, it remains *in situ* (see p. 235). Diseases and abnormalities in development of the foetal membranes. Monstrosities of the foetus have been proved to be causes of abortion.

(3) **Other causes.**

Maldevelopment, or early retrogression of the corpus luteum. It is now known that the corpus luteum persists until about the end of the seventh month, when apparently it has supplied all the hormone necessary for the foetus. Early retrogression, or maldevelopment, is a very real cause of abortion. The author has proved this by giving 5 grains of corpus luteum twice a day to women who have had frequent abortions without apparent cause: the administration has been followed in some instances by a healthy child at full term.

Trauma. A history of a fall may be given in some cases, but a slight fall alone will not determine an abortion where the attachment of the ovum is sound. In other words, a thorough pelvic examination should be made on the woman who gives a history of a fall causing an abortion. It has been well said that a woman with a healthy endometrium may jump off the top of a house without aborting, while a woman whose uterus is unhealthy will abort after a slip from one step to the next.

Criminal abortion. This fact must be borne in mind. If a woman consults a doctor, and he believes a criminal abortion has been attempted, he should immediately call in a consultant. He should treat the case and endeavour to save the woman's life. If he is sure of his facts, and he thinks it advisable, the police should be acquainted, but this step should be taken only after prolonged consideration.

Fright. A fright is said to have caused abortion in

[1] *Handbook of Gynaecology*, by Bethel Solomons.

innumerable instances. It must really be very rare, for except by exciting the lumbar centre in the end, it is difficult to understand how it could occur.

Drugs. Various drugs are said to cause abortion. In most abortifacients, aloes is the chief ingredient, and violent purgatives may be put in the first place. Ergot in various forms, quinine, pituitrin, are all used, but lethal doses must be administered in order to effect separation of the ovum in the presence of a healthy endometrium.

Consanguinity. Consanguinity is not a cause of abortion. A thorough investigation by us into this subject revealed the fact that the average of abortion, monstrosities, etc. in consanguineous marriages is less than in others, unless there is continued inbreeding, *i.e.* the marriage of first cousins is no harm, but if their progeny marry a cousin, trouble ensues. There is an important exception. If, *e.g.*, cousins have a large family, after about four children, imbecility, etc. may arise, *i.e.* cousins should limit the number of their family.

Climate. Very hot or very cold climates are productive of abortion in the races who are unused to these variations of temperature.

Over-indulgence in food, drink, and especially sexual excess.

VARIETIES OF ABORTION

1. **Threatened abortion.** When there is partial detachment, but the ovum continues to live.

2. **Complete abortion.** When the whole ovum has been expelled through the external os.

3. **Incomplete abortion.** When part of the ovum is expelled from and part retained in the uterus.

4. **Missed abortion.** When the ovum dies, but is not expelled from the uterus.

5. **Cervical abortion.** When the ovum is expelled into the cervical canal, and retained there by the closed external os.

Inevitable abortion. This is a term described in various text-books as one that is "bound to occur." It is an unnecessary classification, for those that are

"bound to occur" are embodied in the classification already given.

Estimation of the age of the foetus. Before proceeding with the symptoms, signs, and treatment, it is well to consider the estimation of the age of the foetus. It is

Fig. 113.—Ovum from twelve to fourteen days old, showing the chorionic villi. Natural size. (By permission of the late Mr. J. Keogh Murphy.) Rotunda Hospital specimen.

often important, especially in medico-legal cases, to be able to make this estimation. Different ova develop with different degrees of rapidity, and the following account helps to an opinion which, while it cannot be considered accurate, is approximately so. One method of making an estimation is by the length of the embryo.

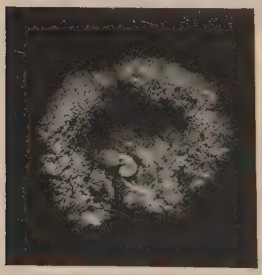


Fig. 114.—Embryo about twenty-three days old lying in the opened chorionic sac. Natural size. Rotunda Hospital specimen.

The following table in centimetres forms a convenient way of remembering the length. Up to the fifth month the length of the foetus for the several months is found by multiplying the number of the month by its own figure. After the fifth month the number of the month is multiplied by 5. Approximately 2·5 centimetres equal one inch.

FIG. 115.—The same embryo as in Fig. 114; magnified. The large yolk-sac is well seen, and the outline of the small amniotic cavity surrounds the head and dorsal aspect of the embryo. (Photographs by Professor A. F. Dixon.)

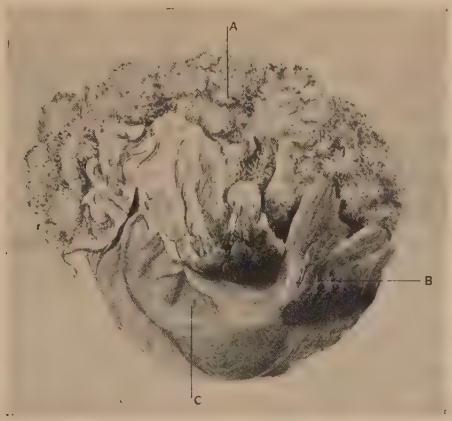


FIG. 116.—Complete abortion, of about three months. The decidua has remained in the uterus. A, chorionic villi; B, blood clot; C, embryo. (Rotunda specimen.)

End of the	1st	month	$1 \times 1 =$	1 cm.
,, ,,	2nd	,,	$2 \times 2 =$	4 cm.
,, ,,	3rd	,,	$3 \times 3 =$	9 cm.
,, ,,	4th	,,	$4 \times 4 =$	16 cm.
,, ,,	5th	,,	$5 \times 5 =$	25 cm.
,, ,,	6th	,,	$6 \times 5 =$	30 cm.
,, ,,	7th	,,	$7 \times 5 =$	35 cm.
,, ,,	8th	,,	$8 \times 5 =$	40 cm.
,, ,,	9th	,,	$9 \times 5 =$	45 cm.
,, ,,	10th	,,	$10 \times 5 =$	50 cm.

End of the first lunar month. The ovum at the end of the first month is about one centimetre long. The eyes, ears, and nose appear.

End of the second month. The ovum is about four centimetres long and is coated with villi. In the embryo the external genitals appear and ossification centres can be found in the lower jaw and clavicle.

End of the third month. The ovum is about nine centimetres long and the placenta is now formed. The umbilical cord shows spiral turns, the fingers and toes are differentiated, the nails can be detected, and the thorax is differentiated from the abdomen.

End of the fourth month. The sex becomes distinguishable and hair appears upon the head.

End of the fifth month. The fine hair, known as lanugo, covers the surface of the body. The foetus has a withered appearance, the skin being red and wrinkled from the absence of subcutaneous fat, and the head very large compared with the rest of the body.

End of the sixth month. The eyelids separate. The foetus, if born, may live a few hours.

End of the seventh month. The child, if born alive, may live a few days, but even at the end of the twenty-eighth week can scarcely be called viable.

End of the eighth month. The child is born alive and can be reared. The lanugo is disappearing from the face, the nails have nearly reached the tips of the fingers, and in a boy one testicle may be found in the scrotum.

End of the ninth month. The skin has by now lost most of its wrinkled appearance owing to a subcutaneous deposition of fat. The lanugo is disappearing from the body.

End of the tenth month. The full-term child measures 50 centimetres, or about 20 inches. The weight of a child is so variable that it is no indication of its age.

Symptoms and signs. The main symptom of abortion is haemorrhage, which is great or small depending on the separation of the ovum. The student must remember that this is always the cause, for he will then know that the way to avoid sufficient separation to terminate the pregnancy is

to adopt measures to keep the foetus at rest (see treatment of threatened abortion).

When the woman bleeds in the early months, abortion must not be diagnosed without excluding first the possible causes enumerated on p. 223. The haemorrhage is sometimes accompanied by pain and contractions of the uterus, and this is an ominous sign. With regular intermittent pain the expulsion of the ovum is to be expected, for these contractions are of a nature similar to labour pains, the pains being due to opening of the internal os.

A vaginal examination must always be made in every case of haemorrhage, and should be made with all the usual aseptic precautions. Note the signs of pregnancy, such as blueing of the vulva and vagina, softness of the cervix, and the size of the uterus corresponding with the patient's history of amenorrhoea. There will very likely be clots of blood in the vagina if the patient has been in bed. Keep them for examination. Then feel the os and cervix. If the abortion is complete, the cervix feels pear-shaped with the apex up, because the internal os closes when the abortion is complete; if incomplete, pear-shaped with the apex down. A little experience makes this a useful distinction. If the internal os is open abortion is very likely, but not certain, to follow. The ovum may be protruded into the cervical canal. This partial expulsion of the ovum from the body of the uterus is a stage beyond that of threatened abortion. Blood clot in the canal may be mistaken for the ovum, but blood clot can be broken up with the finger-tip.

Examine with a view to excluding especially extra-uterine pregnancy and vesicular mole. In the former, a tender pulsating mass is felt either side of or behind the uterus, and separated from it by a groove (see p. 265).

Vesicular mole must be suspected when the size of the uterus does not compare with the stated period of pregnancy. If the characteristic "white currant" cysts embedded in "red jelly" are present, the condition is one of vesicular mole.

Finally, examine the rectum for scybala. These masses can be felt through the posterior vaginal wall; they pit on pressure, and are not sensitive.

Examination of clots. The nurse should always keep anything that comes away in cold water, for the doctor to see. Sometimes the patient does so. Examine blood clots and "lumps of flesh" carefully for bits of ovum, or for "white currants embedded in red jelly," which are the certain sign of vesicular mole, or for a decidual membrane which forms a complete cast of the interior of the uterus, and is expelled in some cases of extra-uterine pregnancy (see p. 264).

Figs. 113–116 show some of the different appearances of abortions. Sometimes the blood, instead of escaping through the os, is extravasated into the decidua outside the membranes, and the ovum becomes a mass of blood clot with withering or absorption of the foetus. This is known as a *carneous mole.*

The full consideration of carneous mole is dealt with later (see p. 250).

Having determined that the case is one of abortion, the treatment must next be considered. This will depend on the variety of abortion present. Each will be dealt with separately, laying special stress on any particular symptoms.

Threatened abortion. This is the variety which is met most commonly, and it is one where a careful diagnosis must be made, for the successful treatment of a threatened abortion may save a child, which would be removed from the uterus by a careless doctor.

The patient, having missed one or two periods, starts to bleed. She calls in her doctor, who finds that there is some slight haemorrhage: there have been no pains, a bimanual examination reveals a closed cervix and a uterus in good position. (*Retroversion* of the uterus is a common cause of abortion, and its replacement, followed by pessary insertion, will prevent many a disaster.)

Some authorities say the replacement of a retroversion will cause abortion. It is more risky to leave the uterus in malposition, and we always advise replacement and pessary insertion. If this replacement cannot be effected satisfactorily bimanually, a bullet forceps on the anterior lip should be used. If the manipulation is painful, gas anaesthesia should be employed.

It is a simple matter to treat this type of case, for the diagnosis is simple.

The patient is kept in bed for five days after the haemorrhage has ceased.

If the patient is restless, morphine sulphate gr. $\frac{1}{6}$ to gr. $\frac{1}{4}$ may be injected, or else a small dose of tincture of opium given (♏x to ♏xv).

The cessation of bleeding is recognised by the colour of the blood and clots. Recent blood is red. Old blood is darker unless it has been exposed to the air.

Calcium lactate in large doses ʒss twice daily is of use. Collosal calcium, 1 c.c. intravenously or intramuscularly, may also be tried. The bowels are kept free. The most satisfactory method of relaxing the bowels is to give a small dose of cascara sagrada, 2 to 4 grains of the extract, or ʒi to ʒii of the liquid extract, followed in twelve to eighteen hours by a small enema, not too hot. The enema should not be massive, and the quantity of fluid should not be more than ℥iv to ℥v of soap and water, or olive oil. Similarly, the purgative must not be severe, and it may be difficult to get the bowels moved, for constipation is quite a common cause of abortion.

A large enema or a strong purgative may determine an abortion. Corpus luteum grs. 5 twice daily may be effective, but this method of treatment is more useful in cases of frequent abortion.

The type of threatened abortion which is difficult to diagnose and treat is the case where there has been a good deal of bleeding, some slight pain, and the cervix is indefinite. The best plan to adopt is to treat every case as "threatened" until it is certain that the uterus *must* be emptied.

The patient must be warned that she is likely to abort later, for one haemorrhage indicates a likelihood of recurrence.

She should be advised to—

(1) Stay in bed when each period is due, for this is the most likely time for abortion to occur;

(2) Avoid coition;

(3) Keep the bowels free;

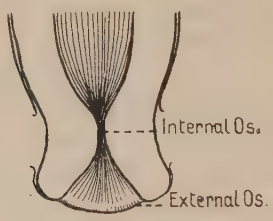
(4) Avoid anything likely to shake her about and separate

the ovum, *e.g.* cycling, motoring, riding, gardening, lifting heavy weights, etc.

If she has aborted previously, and if her social state allows her, she should stay at rest in bed until the child is viable. This is a very severe treatment, and the patient should have some companion to look after her and keep her cheerful. Finally, remember the rules "when to empty the uterus" (p. 237), and do not regard the case as threatened when emptying is the correct treatment.

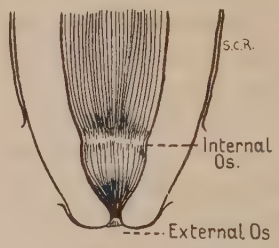
Complete abortion.

Symptoms. Usually the patient has a severe haemorrhage, and the whole ovum comes away. The bleeding then ceases.



COMPLETE ABORTION

FIG. 117.



INCOMPLETE ABORTION

FIG. 118.

On arrival at the case the doctor will find the ovum kept in water, when he can examine and determine if it be complete or not; if not, a vaginal examination is made, when the whole ovum may be discovered in the vagina. The cervix is pear-shaped with the apex up, *i.e.* the internal os is closed, the external is open. When there is still something in the uterus (incomplete abortion), the cervix is pear-shaped with the apex down, *i.e.* the internal os is open (see Figs. 117, 118).

Treatment. Treat as an ordinary confinement. Keep the patient in bed for a week. Give her a little ergot, *e.g.* ergotamine tartrate, one pill twice daily. This helps involution.

Provided her temperature and pulse remain normal, there is nothing further to be done: if the temperature should rise, a mistake in diagnosis has probably been made, and

there is still part of the ovum in the uterus which must be removed.

Incomplete abortion.

Symptoms and signs. The bleeding does not stop: it may increase in severity, or it may continue dribbling away. Small pieces of chorion may be discernible in the lochia. A smell may be noticed. At any time there may be a severe gush of haemorrhage. Soon the temperature rises to a slight or alarming degree, accompanied by a corresponding rise in pulse rate. A vaginal examination reveals the cervix pear-shaped, apex upwards, and pieces of blood clot and membrane may be felt through the cervix.

Treatment. When it is definitely decided that part of the ovum has come away, as evidenced by the above signs, the uterus should be emptied. The fact that part of the ovum has come away is diagnosed by (1) seeing it, (2) shape of the cervix, (3) feeling it through the cervix, (4) continuous bleeding for several weeks, (5) foetid discharge.

The method of completing an abortion is described later (p. 237).

Missed abortion. Where the ovum dies and is not expelled.

Symptoms and signs. In a typical case a history is given of amenorrhoea for four months. In the ordinary way, if the ovum dies it is expelled. In this case the patient expects to find herself getting larger. Instead, there is no increase in the size of the abdomen, the breasts remain flabby, she complains of a bad taste in the mouth, there is a feeling of nausea, and a brown vaginal discharge which is sometimes smelly. A vaginal examination then determines the uterus to be about the size of two months. If necessary, an X-ray examination will determine the diagnosis, for at four months foetal parts would be discernible by the rays.

It has been suggested that the temperature of the cervical canal is higher when the ovum is dead than when alive: we have not found this to be a reliable or a practical guide.

Treatment. Empty the uterus—this is discussed later.

Cervical abortion. When the ovum is expelled into the

cervical canal and retained there by the closed external os. This, in our experience, is very rare. The ordinary symptoms of abortion are present, and a vaginal examination reveals the cervix bulged by the ovum.

Treatment. The ovum must be removed. This can usually be done quite easily by bimanual expression. If this is impossible, dilatation with small-size Hegar's dilators will allow it to be done.

It has been suggested that snips with scissors would be effective, but we have not found this to be necessary.

Septic and criminal abortion. This may arise in one of two ways. An ordinary abortion may become *septic* by carelessness in technique.

Criminal abortion is usually a synonymous term with septic abortion, because it is only discovered when severe sepsis arises. It is most usually caused by rupture of the uterus with a dirty catheter or other instrument. The practitioner must take great care how he involves himself in a case of true criminal abortion: most of these cases are undertaken by unskilled and unscrupulous persons, and a lack of aseptic technique, together with severe traumatism of the uterus, may be sufficient to produce severe symptoms.

Symptoms. Raised temperature and pulse. Severe hypogastric pain with local and possibly general peritonitis. A foetid or haemorrhagic discharge.

Treatment. This will depend on several things. If there is obviously an ovum still in the uterus, it should be removed.

The finger should be used—not a curette, for the uterus may have been ruptured, and even if this has not occurred, the curette may light up infection. If there is no obvious ovum in the uterus, it is wiser to explore with the finger to make sure, then give an intrauterine douche under very low pressure, and plug the uterus with gauze. Further treatment must depend on the symptoms, *i.e.* general peritonitis, abscess formation, etc.

A swab should be taken with a view to treatment by vaccines, and the general treatment for sepsis should be carried out (see p. 548).

When there is a localised septic condition of the uterus

combined with rupture, hysterectomy is occasionally indicated.

When to empty the uterus in case of abortion. It is well to consider here in detail when to empty the uterus. The indications for induction of abortion for other conditions will be dealt with elsewhere.

1. If, in spite of treating the case as one of threatened abortion, bleeding continues for about six weeks, this must mean the ovum is dead, and the uterus must be emptied. Several weeks might be a better term, but six weeks may be taken as a maximum.

2. If the bleeding is severe, either the ovum is dead or part has come away.

3. When cervical abortion has occurred.

4. In incomplete abortion.

5. For missed abortion.

6. When constitutional symptoms arise, *i.e.* signs of collapse, rise of pulse rate, pallor, etc.

How to empty the uterus. This can be done—

(1) With the fingers.

(2) With a flushing curette. (Rheinstädter's is the one we most commonly use (see Fig. 119).)

(3) With an ovum forceps (see Fig. 120).

(4) With a Schultze spoon forceps (see Fig. 121).

(5) By means of tents or metal dilators.

(6) By plugging the vagina (very seldom done).

(7) By gauze in the uterus (a bad method).

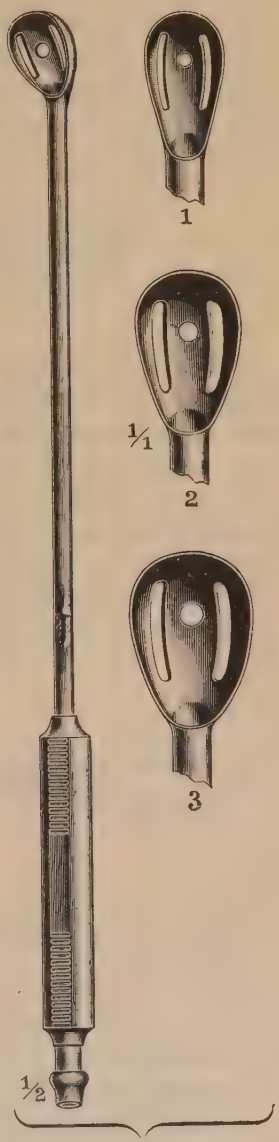


Fig. 119.—Rheinstädter's flushing curette.

Technique. Before attempting any of these methods, certain points must be attended to.

If there is time, the bowels should be well cleared by a purgative followed by an enema: if, however, speed is necessary, the enema should be dispensed with: otherwise there will be a flow of enema fluid over the vulva—a state of affairs which may lead to infection.

Fig. 120.—Ovum forceps.

Position of the patient. She should be in the cross-bed position. If the doctor is alone, he can get her to place her feet on his knees; the legs can be placed over the backs of two chairs, or else the portable leg-rests (see Fig. 122), as illustrated, should be used. These are excellent in private practice, and can be carried in the bag. In hospital the assistants hold up the legs.

A long mackintosh with sleeves to the elbows should be worn, and this covers the knees and dips into the bath under

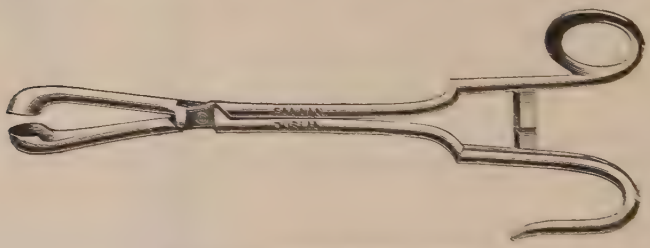


Fig. 121.—Schultze spoon forceps.

the bed. If possible, an aseptic white coat with long sleeves should be worn. When used in private practice, it must be remembered that it may touch furniture, etc., and should be regarded as "dirty"—in other words, do not touch it with sterile instruments or gloves.

Anaesthesia. This will depend on the method used, and on the temperament of the patient; *i.e.* if she is nervous and keeps the abdomen rigid, anaesthesia should be used: if she has not had a full-term child, the same remark applies.

If the method to be adopted is to place the half hand in the vagina with two fingers in the uterus, an anaesthetic will be necessary. If, however, she is not nervous, is a multipara, and the curette or forceps is used, she will not require any narcosis unless marked instrumental dilatation of the cervix is required.

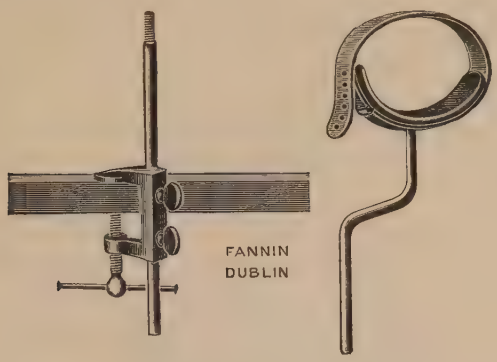


Fig. 122.—Portable leg-rests.

Instruments, etc., required.

Portable leg-rests for private practice.
A rubber douche bag, with tubing.
Ring forceps.
Catheter.
Glass nozzle.

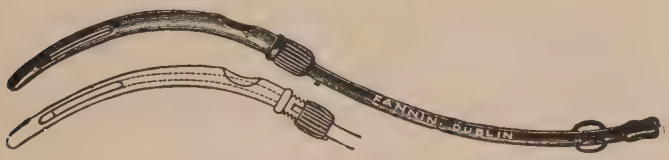


Fig. 123.—Bozeman's uterine catheter.

A small Bozeman's return flow catheter (see Fig. 123).
An ovum forceps. A Schultze spoon forceps.
Rheinstädter's flushing curette.
Plugging forceps. Two bullet forceps. Posterior speculum.
Rubber gloves, and other necessities for asepsis, such as wool, antiseptic.

Necessity for antiseptics. While complete asepsis is necessary in any operative procedure, antiseptics are not absolutely necessary, although they may help to a small degree. A few drops of lysol or cyllin may be used in the basin of swabs. We use cyllin in the strength of ʒss to O j in the douche. If we have not got this to hand, we use salt solution ʒj to the O j. Cyllin is a satisfactory antiseptic in that it is relatively non-poisonous: it does no harm, but may do good. Antiseptics are a real danger if, relying on their power, nurses and doctors slacken the care with which they clean their hands by scrubbing, and with which they cleanse the instruments by boiling, and the external genitals by washing.

The temperature of the douche is between 100 and 105° F., unless severe haemorrhage should be encountered, when the temperature should be between 115 and 120° F. Cyllin should be mixed with cold water before adding the hot, otherwise a flocculent precipitate will appear.

Cleansing the hands. The hands should be made surgically clean, then fresh water should be used. Orders are given in the Rotunda, that students should wash up for four minutes, and a sand-glass is used to ensure this. When a doctor is continuously scrubbing, this is too long, and experience will direct the time taken. A soft nail-brush is used, and the soap is rinsed off, after which the hands are soaked in biniodide of mercury 1/1000 for a minute and a half. Soap decomposes the mercuric solution. The boiled gloves are then put on, and should be filled with some watery solution: they then slip on easily. Every doctor should know how to put on gloves in an aseptic manner.

When dry sterilised gloves are used, the hands must be well powdered with aseptic powder.

Preparation of the patient. The external genitals are first cleansed (see p. 139). The bladder is catheterised and a vaginal douche is given.

The various methods of removing the ovum.

1. Fingers in the uterus.

In order to do this successfully, the cervix must admit

two fingers, and the patient must be anaesthetised. It is the ideal method and ensures that the uterus is really empty.

The patient having been prepared, the half hand, or, in the case of a multipara, the whole hand, is placed in the vagina, the first two fingers are inserted in the uterus, and the ovum is separated from its attachment, counter-pressure being exerted by the other hand on the abdomen (see Fig. 124).

Fig. 124.—Bimanual removal of ovum.

When the ovum is free it can occasionally be removed with the fingers. More commonly this is impossible; the fingers are withdrawn from the uterus, and the ovum is expelled by bimanual compression—fingers in anterior fornix, hand on abdomen. If the uterus is retroverted, the fingers are placed in the posterior fornix. The fingers are then reinserted in the uterus to make certain that it is empty. A hot intrauterine douche is given with a Bozeman's catheter, and a wick of gauze inserted. This wick helps the uterus to contract, and when removed brings with it any shreds of ovum which may have been left behind.

With a flushing curette. This method is not nearly so

satisfactory as the "finger method." It is suitable, however, when an anaesthetic is not used, and when the cervix admits one finger or less. When the cervix is not large enough to admit the curette, dilate with Kelly's modification of Hegar's dilators until it does. If the cervix is painful, and a general anaesthetic has not been used, novocain ½ per cent. may be injected into the cervical tissues.

Careful technique must be followed.

After washing the external genitals and douching the vagina, a bullet forceps is placed on the anterior lip of the cervix, and a posterior speculum is passed. The external os is cleansed with wool soaked in 1/1000 biniodide of mercury, and the cervical canal with wool on a forceps in picric acid in alcohol. Dilators when necessary are then used. Great care must be taken not to exercise undue force. No. 18 is the largest size required, and No. 14 diameter is usually sufficient. The flushing curette attached to the tubing is passed up to the fundus and scraped gently round. Efforts are made to entangle the ovum in the curette: if these are unsuccessful, it may be removed in some instances by bimanual compression or with a small ovum forceps. Next douche out the uterus with a Bozeman return flow catheter, and insert a wick of gauze. The Rheinstädter's curette in common use is a modification: the original instrument had a flexible stem, and was really more useful.

Ergotamine tartrate citrate gr. $\frac{1}{130}$ is now given as a routine by the mouth, three times a day for a week.

With an ovum forceps or a Schultze spoon forceps. These are both useful, and may be used either alone or in combination with the methods just described. The forceps is passed into the uterus and entangles the ovum. A douche is then given, followed by the insertion of a wick of gauze.

By means of tents. This is specially useful in inducing labour in cases of missed abortion. These are made of laminaria wood: they can be bought already sterilised, but for hospital use they should be sterilised by the sister in charge of the theatre. They act by absorbing moisture and thus expanding. A tent when removed is four to six times its diameter when inserted. They are sterilised as follows:—Place them in Jellett's catgut steriliser and cover

them with methylated spirit: tightly screw the top on. Place the box in a saucepan of cold water. Make sure there is plenty of water, for boxes have been known to burst by allowing the water to boil dry: this might cause serious or even fatal results. Boil for half an hour: the tents are then sterilised in superheated alcohol and are then transferred by sterilised forceps to a jar containing absolute alcohol (see Fig. 125).

How to insert the tents. All aseptic precautions having been taken, a bullet forceps is placed on the anterior lip of the cervix, and a posterior speculum is passed. The cervix is then cleansed with sterile wool soaked in weak biniodide solution: the cervical canal is swabbed with wool soaked in tincture of iodine. Insert from one to six small tents as the cervix allows: they should be small, for there might be difficulty in removing one large tent. They are left *in situ* for twenty-four hours, when they are removed. In the case of abortion, the ovum can then be removed by the fingers or the ovum forceps, Schultze spoon forceps or the Rheinstädter's curette.

Fig. 125.—Laminaria tents in alcohol.

Some advise leaving the ovum to come away. While this may be advisable in miscarriage or labour cases, where there is placenta formation it is not advisable for early abortions. An anaesthetic is not necessary for tent insertion.

Dilatation with metal dilators. Kelly's modification of Hegar's dilators are used preparatory to using the curette. Frommer's dilator (see Fig. 126) is occasionally used, but it acts by tearing the cervix, not dilating it. Except under very exceptional circumstances it should be avoided. On it there is a graduated scale. After a bullet forceps has been placed on the cervix, and a posterior speculum passed, the cervix is cleansed, and the dilator is inserted. It is turned very slowly, taking two minutes to each figure of the scale.

Plugging the vagina and uterus. These methods of

inducing abortion were suggested in our previous editions, but we do not recommend them now. Plugging the vagina used to be done for accidental haemorrhage, but we have nearly given it up as a treatment. At the same time it may be useful in rare instances in abortion, accidental haemorrhage, and in placenta praevia. The only type of abortion where we can conceive it to be useful is a case where the patient is bleeding profusely, and where there is no time to start actually emptying the uterus. The patient is in collapse, and plugging will serve admirably as a temporary measure, for it stops the haemorrhage and starts labour pains. The collapse can then be combated by submammary saline, etc. When the patient has recovered

Fig. 126.—Frommer's dilator.

somewhat, the plugs are removed, the cervix will be found dilated at any rate to admit two fingers: the ovum can easily be removed, and the vagina douched. This is the only type of case where plugging the vagina is indicated in abortion.

The technique, advantages, disadvantages, and other points about plugging the vagina are discussed on p. 566.

The insertion of gauze either dry or soaked in boiled glycerine acts as an irritant in the uterus, and is *not* recommended as a method of emptying the uterus.

Douching the uterus and its dangers. The uterus is douched in one of two ways. (1) After all aseptic precautions, a bullet forceps is placed on the anterior lip of the cervix, and a posterior speculum is passed; the cervix is cleansed and the Bozeman's catheter introduced. (2) After aseptic precautions, the Bozeman's catheter is passed by touch up to the cervix and introduced into the uterus. Small shreds of ovum and decidua may catch

in the catheter, and should be removed, for they block the return flow.

The *dangers* of douching the uterus and the ways to avoid them are :

1. Rupture of the uterus by the nozzle. Use a large round-ended nozzle, never push hard.

2. Distension of the uterus with fluid has led to death. Fluid has even been forced through the Fallopian tubes into the peritoneal cavity. Distension is avoided by using a Bozeman's catheter with its large return flow tube. Sometimes the return tube gets blocked by a blood clot. To avoid this move the catheter gently to and fro in the uterus, and watch for the free return of the fluid.

3. Patients have died from antiseptic poisoning. Cyllin is relatively non-poisonous.

4. Air has been forced into the uterus and fatal air embolism is said to have resulted. If the catheter, before insertion, is held with its point upwards until fluid flows out as it does from a fountain, there will be no air in it.

5. A clot of blood is said to have been forced into a vein, causing fatal pulmonary embolism. To avoid this, never have the douche can more than two feet above the bed. A great rush of fluid is thus prevented.

6. Injury may be done to the inside of the uterus by having the fluid too hot or too strong. These dangers can be avoided by observing the rules already laid down regarding the temperature and strength.

THE AFTER TREATMENT OF ABORTION

The after treatment recommended here applies to miscarriage also. It consists primarily in finding out the cause of the abortion which has occurred and endeavouring to correct it, in order to avoid further mischance.

When there is something evidently wrong, such as endometritis or retroversion of the uterus, the efforts to cure will be comparatively simple. The difficult case to combat is, when constitutionally and locally the woman is apparently normal. Many doctors recommend curettage of the uterus as a routine. Our practice is to examine the woman from four to six weeks after the abortion has occurred. If all

appears normal, tell her to have nothing done unless the periods become heavy, thus showing there is some congestion and hyperplasia present. If this occurs, curette. In addition she must be warned to follow the rules for the prevention of abortion already described (see p. 233). Curettage alone is very little use.

A word of warning must be uttered here. If the menses are normal and curettage is not advised, the patient *may* abort and blame her doctor; the practitioner is warned, therefore, in order that he may save himself from reproach, to explain to his patient that curettage is unnecessary, and if done will not save abortion should it occur again: in other words, the best has been thought out by the doctor, and the patient must not "cry over spilt milk!"

MISCARRIAGE AND PREMATURE LABOUR

Miscarriage is best applied to the separation of the ovum from the beginning of the fourth to the beginning of the seventh lunar month. During the end of this period the child may breathe (immature delivery) and may even live for a day or two, but it is not really viable until the seventh month, when it attains a weight of at least 3 lbs. Miscarriage is not so common an occurrence as abortion, and its chief importance lies in the presence of the placenta.

Causes. These are the same as those of abortions.

Varieties.

Threatened miscarriage.
Complete ,,
Incomplete ,,
Missed ,,
Criminal ,,

Symptoms, signs and treatment. The symptoms and signs of threatened and criminal miscarriage are the same as those of abortion.

A complete miscarriage is sometimes expelled entirely, and it is a simple matter to detect this. A complete miscarriage may occur like an ordinary birth. The foetus is first born, and is followed by the placenta in due course. When the head presents, care must be taken not to pull it off the body: if such an accident should occur, the trunk

can be delivered with an ovum or Schultze spoon forceps. When the breech presents, the body should be pulled on, thus acting directly contrary to the advice given for the conduction of a full-term breech. The idea in this is to cause extended arms, and thus try to prevent the small head from becoming caught in the cervix. If the head happens to be caught by the cervix, the best plan is to apply a bullet forceps or a small ovum forceps to it, at the same time drawing on the feet. If the head be left behind in the uterus in spite of all, it should be expressed as far down as possible, after which it is removed either with ovum or Schultze spoon forceps. The majority of miscarriages are spontaneous.

Incomplete miscarriage. The foetus is expelled, and the placenta is left in the uterus. By examination of the foetus, the *cord* is seen, and it is thus known that the placenta is still *in utero*. Sometimes it is broken off, sometimes it must be cut. Twenty to thirty minutes are allowed to elapse before efforts are made to express the placenta from the uterus. If this cannot be done—and often the placenta is retained simply or morbidly in these cases—it must be removed. *On no account* must it be left to chance in the puerperium to evacuate the placenta. We have too often seen neglected cases of this type, and it must be emphasised that when the placenta cannot be expressed, it must be removed.

Method of removing a miscarriage placenta.

1. With or without anaesthesia, an ovum forceps or Schultze spoon forceps is passed up to the uterus and the placenta removed.

2. Under anaesthesia, with the half or whole hand in the vagina, two fingers are placed in the uterus, and the placenta removed. If it be morbidly adherent, the fingers must be reinserted to ascertain that the cavity is free. We do not advise the use of Rheinstädter's flushing curette in cases where there is placenta formation.

Missed miscarriage and missed labour. These two must be taken together. They signify that the foetus at any time from the third month onwards has died but is not expelled.

Diagnosis.

Symptoms. These are sometimes very indefinite, at other times they are obvious.

The mother complains that she does not feel the foetal movements she has previously felt. This point must be carefully investigated, for a dead foetus may roll about and simulate the movement of the living.

Six periods, for example, have been missed, but the uterus has not grown after four months, the breasts are flaccid, there is a bad taste in the mouth, there may be vaginal discharge haemorrhagic or foetid. The temperature and pulse may be raised.

Signs. Palpation of the fundus reveals it to be lower than it should be for the time of amenorrhoea. No foetal heart can be heard. Measurements confirm the diagnosis.

See first that the bladder and rectum are empty. This can be done by giving a purge, and asking the patient to urinate before examination. Measure the greatest girth round the uterus with a steel tape measure, also the distance from the ensiform cartilage to the top of the fundus, and from the top of the fundus to the pubes. Measure again in a week's time, and, if the foetus is dead, the measurements will possibly be actually less. If still in doubt, measure again in a fortnight, and again in three weeks. A comparison of the first measurements with those taken three weeks later will determine whether the foetus is dead or alive. At the same time the breasts become flabby. If a brown discharge appears it confirms the suspicion.

A dead foetus macerates, and may macerate very quickly. In missed labour one may be able to feel by vaginal examination the loose bones of the skull, and so know the child to be dead.

In addition, X-rays may help by showing an overlapping of the bones of the cranium in the case of a dead foetus.

Very rarely the dead foetus mummifies, and this may occur with one of twins. The dead twin is crushed by the living twin and forms a parchment-like foetus (foetus papyraceus).

Treatment. When absolutely certain that the foetus is dead, the uterus should be emptied. If not certain, and

there are no indications for delivery, act according to the symptoms and signs given above. It cannot be urged too strongly that every precaution should be taken to diagnose the death of the foetus.

How to empty the uterus for miscarriage. The best method is the use of sea-tangle tents (see p. 243). The technique for miscarriage is slightly different from that for abortion. Tents are introduced and removed in twenty-four hours; the cervix should then admit two fingers. More tents are then introduced. When they are removed, the cervix is larger and one of two things can be done. The patient may be left alone, and labour, when it comes on, allowed to progress naturally. Sometimes labour does not start properly for at least twenty-four hours, and it may be aided by giving small doses of pituitary extract—2 to 3 minims. Another way of dealing with the case is to perform version in the case of a head presentation, and bring down a foot, or to draw down a foot if a breech present: this often accelerates the labour, which is allowed to proceed naturally after the version.

If the cervix is not large enough and it is decided not to use either of these methods, the cervix may be dilated with Frommer's dilator, or even Bossi's, which contains four blades, if the former is not available. A foot should then be brought through the cervix, and the patient left to deliver herself. If the cervix admits two fingers, the advisability of inserting a Champetier de Ribes bag or other hydrostatic dilator may be considered. The first suggested method (insertion of tents followed by version) for emptying the uterus is the best. Metal dilators like those of Frommer and Bossi tear the cervix in addition to dilating it, and the use of the bag at such an early date is very seldom possible in practice.

CHAPTER XI

HAEMORRHAGES (*continued*): MOLES

FOLLOWING the consideration of abortion, it is advisable to consider a somewhat kindred subject—**Uterine Moles.**

A *mole* may be defined as a change in the foetal membranes which partially or entirely destroys the ovum during the early months of pregnancy. These moles are usually described as "uterine moles," but they are found in the Fallopian tube as well. There are two main varieties:

(1) The Carneous Mole.
(2) The Vesicular or Hydatidiform Mole.

The Carneous Mole (see Figs. 127–130). This is also called blood mole, flesh mole, and haematoma mole.

Cause. A haemorrhage which is probably due to increased activity of the trophoblast arises from the blood vessels into the decidua. This soon invades the chorio-decidual space: here the extravasated blood finds the chorionic villi, which are soon broken up, and ridge-like elevations are evidenced. If the haemorrhage is severe and sudden, the ovum will die immediately: it is usually gradual, however, and destroys the ovum slowly. The ovum may be entirely destroyed, but is sometimes seen rather crushed out of existence. The resisting amnion may be found intact in many cases. The diagrams illustrate clearly what happens:—(1) shows the normal arrangement of the ovum; in (2) there is haemorrhage into the decidual tissue; (3) shows the chorio-decidual space full of extravasated blood, while (4) demonstrates destruction of the villi, the ovum being nearly crushed out of existence by consolidated blood.

It is impossible to determine the reason for this haemorrhage. Syphilis may be found in some instances, but any

of the ordinary causes of abortion (see p. 225) may be taken as possible determining factors.

Symptoms. These are exactly the same as those of abortion. In fact carneous mole can seldom be diagnosed until a careful examination of the specimen is made.

Signs. These are like abortion, and will simulate abortion to a large degree. This is explained by the slow

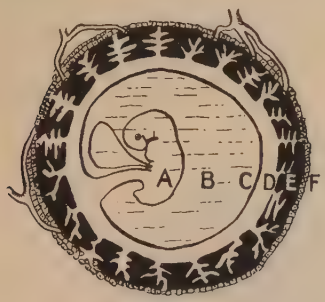


Fig. 127.—Normal ovum.

Fig. 128.—Carneous mole.

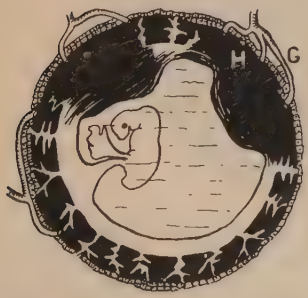


Fig. 129.—Carneous mole.

Fig. 130.—Carneous mole.

Diagrams to show formation of carneous mole:—A, embryo; B, amniotic fluid; C, amnion; D, chorionic membrane; E, chorionic villi and chorio-decidual space; F, decidua; G, maternal vessels; H, extravasated blood; I, consolidated blood.

nature of the haemorrhage causing gradual destruction of the foetus, and the uterus is therefore not as large as would be expected from the time of amenorrhoea.

Treatment. If diagnosed definitely, empty the uterus. It is difficult to make a definite diagnosis, and the case may therefore be treated as one of abortion.

When the specimen is examined, it will appear to be blood clot. On close and further examination, the wall of

the mole is seen to be somewhat polypoid from the constant haemorrhage.

The foetus may have disappeared or will be found to be smaller and degenerated. The exact pathology of the condition is still *sub judice.*

When mole occurs in the Fallopian tube, a diagnosis will be impossible. The condition will be diagnosed as extra-uterine pregnancy, and will be treated as such. The cause of the condition is the same as when it occurs in the uterus.

Vesicular or Hydatidiform Mole. This is a fairly

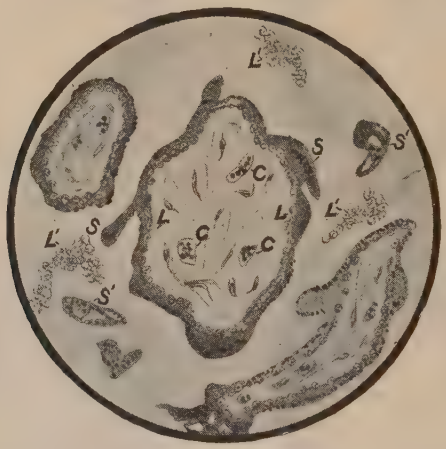


Fig. 131.—Normal chorionic villi. (From the author's *Handbook of Gynaecology.*)

common condition, and as a diagnosis of it from other haemorrhages in the early months must be made, it is considered here.

It is called vesicular, because it is characterised chiefly by the presence of a series of vesicles : its synonym hydatidiform is meant to express its likeness to the hydatid cyst, with which it has *no* pathological connection whatever. It may be best and most easily defined as a cystic degeneration in the chorionic villi.

In order to understand its occurrence, the normal arrangement of the villi must be studied (see Fig. 131).

This illustration shows the core covered by the trophoblast, which consists of foetal cell layers. The inner is called

Langhans' layer (L), the cells of which are recognised by their large pale-staining nuclei. This layer disappears at about the fourth month. The outer layer, or syncytium (S), is composed of fused cells the nuclei of which are small, darkly staining, and occur irregularly. The syncytium often shows papillomatous-like projections, and normally shows a certain amount of vacuolation. Small areas or islands of trophoblast may occur among the villi. They may be composed of syncytium (S′) or Langhans' cells (L′).

Pathology and cause. It is a disease of the chorion where both Langhans' layer and the syncytium undergo

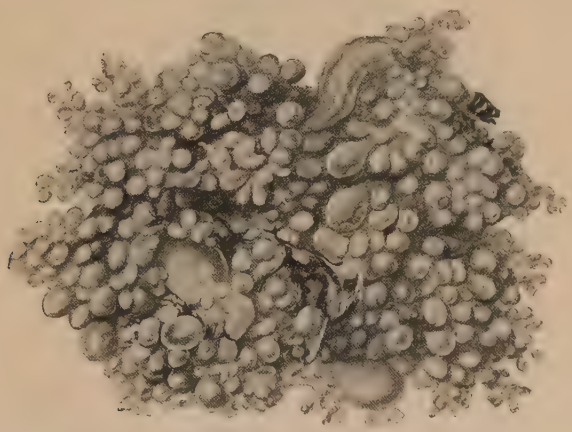


Fig. 132.—Vesicular mole. (Rotunda specimen.)

proliferation. There is some oedema of the vesicles—a condition which in former days used to give the impression of mucin—a theory which is now known to be incorrect. Its cause is not established. There is a definite relationship between it and lutein cysts in many cases, but this is not constant.

The gross appearance is that of numerous transparent cysts enmeshed in blood-stained discharge which comes from the decidua: the cysts vary in size (see Fig. 132). They are seen to be attached to the uterus *in situ*. Usually the disease starts before the placenta is formed. Rarely the disease starts after the formation of the placenta, which may itself be affected by the vesicular degeneration. It is also seen occasionally in the tube.

The decidua shows round-celled infiltration which may be a protective policy.

Microscopically, proliferation of both layers with degeneration of the core of the villus (Fig. 133). The mole may remain simple, or erosion of the uterine wall may occur, when the condition is known as malignant mole. The mole usually grows with more rapidity than a normal ovum, so that a three-months uterus may reach to the umbilicus.

Signs and symptoms. Haemorrhage occurs in the first four or five lunar months, usually in the first two or

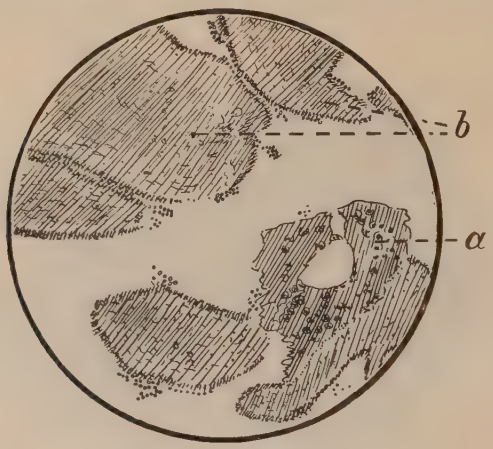


FIG. 133.—Hydatidiform mole.
a, syncytial cells; *b*, oedematous villi.

three months. The haemorrhage may be slight or severe, and is accompanied by the presence of cysts, giving it the well-known description of "white currants in red jelly." Occasionally there is no haemorrhage, and the patient complains of irregular more or less severe pain in the pelvis and lower abdomen. A bimanual examination reveals that the uterus is far larger than the time of pregnancy indicates. In addition, it is softer and more boggy, and many of the ordinary signs of pregnancy are absent. This enlargement is due to growth of the mole and internal haemorrhage, which may be great, and which accounts for exacerbation of pain.

The **Diagnosis** may be difficult, for it may be compared

with (*a*) twins, (*b*) ordinary pregnancy with incorrect dates, (*c*) a degenerated fibroid.

The first of these will make the diagnosis more difficult, for twins at four months may make a uterus appear to be at six months. X-rays have been found very useful in helping the diagnosis.

We have seen a case of twins which simulated a vesicular mole. Once the vesicles appear, the diagnosis is a simple matter. These, if not evident at the vulva, may be found on the finger after making a vaginal examination.

Treatment. The uterus must be emptied once the diagnosis is made; the cervix must be large enough to admit three or four fingers into the uterus so that the mole may be removed quickly: if this is done slowly, excessive haemorrhage occurs. Therefore, if the cervix is large enough for this, remove the mole quickly, douche the uterus, and plug with iodoform gauze. If the cervix is not large enough, insert sea-tangle tents. When they are removed in twenty-four hours the cervix may still not be large enough: fresh tents are then inserted. In twenty-four hours, either labour pains will have started and will have expelled the mole, or else the cervix will be large enough to admit the necessary half hand to remove it. If the mole has *apparently* all come away, a definite examination of the uterus should be made to make sure all is clear.

There are some cases where there is such severe bleeding that something must be done immediately and yet the cervix is closed. Either of two courses may be pursued. (1) Plug the vagina for six hours: remove the plug, when the cervix will be found large enough to permit emptying of the uterus. (2) Dilate with Hegar's or Frommer's dilator, and remove the mole immediately.

No curetting should be done at this stage. In two or three weeks the uterus should be curetted with a sharp curette to diagnose if chorion epithelioma has occurred. If the curettings are satisfactory there is no need to worry further unless there is irregular haemorrhage later, when another diagnostic curettage should be carried out.

Chorion epithelioma and malignant mole. This condition, which has various synonyms, *e.g.* deciduoma

malignum, chorionic carcinoma, etc., is a malignant condition which may arise in several ways. It may follow abortion, miscarriage, or labour, or it may be a sequel of vesicular mole.

In the first three the patient, at any time from two weeks to some years after labour, develops a stinking discharge with much blood loss. If soon after labour the diagnosis may be difficult, for it is necessary to distinguish between such varying conditions as placental remains, uterine polypus, carcinoma of the uterus. If in doubt, a diagnostic

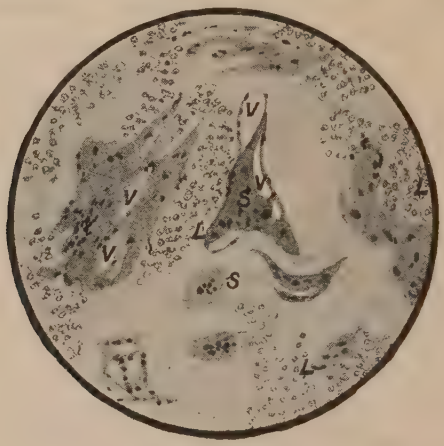


Fig. 134.—Chorion epithelioma. (From the author's *Handbook of Gynaecology.*)

curettage will settle the question. In addition, the uterus when examined is large and boggy, and a growth may be felt protruding through the cervix.

In the case of malignant mole there is a history of vesicular mole in which the mass has been extruded or removed. The first curettage, two weeks after, may give the diagnosis of malignancy, or else there may be no malignancy discovered at this period. Some weeks or months later, a sudden haemorrhage makes necessary another curettage, when chorion epithelioma is discovered. According to some authorities, a vesicular mole is a transitional stage between normal pregnancy and chorion epithelioma: this makes it all the more necessary to curette after mole.

Pathology. The component cells originate from either

Langhans' layer, the syncytium, or from both. In the illustration (see Fig. 134) irregular masses of syncytium (S) are seen showing well-marked vacuolation (V). Large

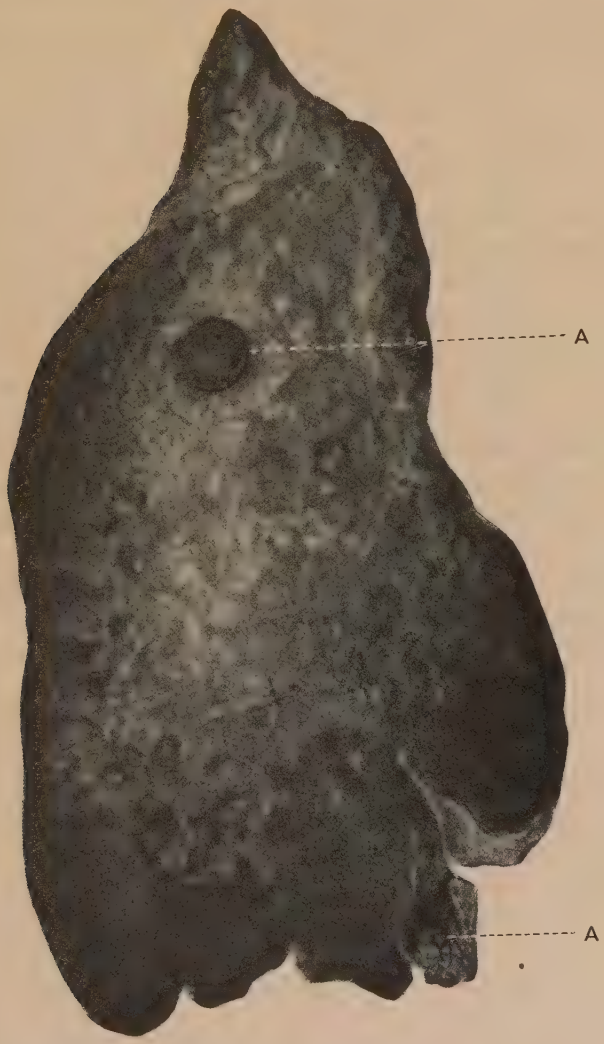


Fig. 135.—Metastases (A) in lung from case of chorion epithelioma. (Case of author and E. C. Smith.)

irregular proliferated masses of Langhans' layer are also seen. Haemorrhagic extravasation along the tumour is common. In order to understand this, Fig. 131, showing the history of a normal villus, should be consulted. *Macro-*

scopically it just appears as a small nodule in the muscle, then, as it increases in size, haemorrhagic areas appear with necrosis, and the tumour has then the appearance of a large haemorrhagic friable mass.

Course of the disease. When diagnosed early, and operated on immediately, cures are nearly certain. Often it is discovered too late, or even if discovered early it has advanced too far, for the mass quickly invades the uterine walls, and either affects the abdomen or else makes its way into the blood vessels, and thus into the general circulation. Metastases quickly follow, and are usually found in the lungs, vagina, and brain. When in the lung or vagina they appear as bluish plaques, rather like little haematomata (see Fig. 135).

In the lungs they give evidence of their appearance by the onset of haemoptysis.

Treatment. Total hysterectomy is the only treatment. This may be attempted even in the presence of metastases, for a peculiarity of the disease is that when the main mass has been removed, the metastases sometimes become surrounded by connective tissue, and are ultimately absorbed. In our experience this is rare, and once metastases have formed, death occurs in spite of operation.

CHAPTER XII

HAEMORRHAGES (*continued*)

ECTOPIC GESTATION OR EXTRA-UTERINE PREGNANCY

By this is meant that the ovum, having been fertilised, continues to grow outside the uterus. The exact place where fertilisation occurs is not known: it is believed that the tube is the situation—that having been fertilised, the ovum passes into the uterus, where it becomes embedded: if it fails to find its way to the uterus, various phenomena may occur.

It may remain in the tube as a tubal pregnancy; it may be fertilised in the ovary and remain there as an ovarian pregnancy, without ever reaching the tube—a very rare occurrence.

As a very exceptional circumstance it may pass into the abdominal cavity and grow as an abdominal pregnancy: this may be a primary or secondary condition. Pregnancy may occur in the horn of a bicornuate uterus.

The main classification of ectopic pregnancy must be made into:

1. **Ovarian pregnancy.** This is an extremely rare occurrence, in which the ovum is fertilised before leaving the ovary, after which it remains implanted. Ovarian pregnancy from a clinical point of view does not differ from tubal pregnancy. The physical signs and treatment are the same.

2. **Tubal pregnancy**, which may be divided into:

(1) Interstitial.
(2) Isthmial.
(3) Ampullary.

By *Interstitial* pregnancy is meant that the ovum develops in that part of the tube which passes through the uterine muscle.

Isthmial pregnancy is where the pregnancy is in the isthmus of the tube, while *ampullary* pregnancy is the development of pregnancy in the ampulla.

Fig. 136 represents the various sites where ectopic pregnancy may arise, giving the directions in which rupture may occur. It will be noted in this diagram that the interstitial may rupture into the abdominal cavity or may abort into the uterus: the isthmial may rupture into the abdominal cavity or into the broad ligament, after which it may continue to grow and be followed by secondary rupture into the abdomen.

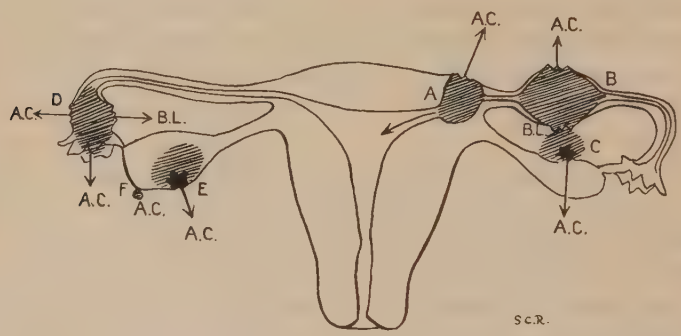


FIG. 136.—Diagram of locations of ectopic ova and their points of rupture.

A, interstitial; B, isthmial; C, ovum ruptured into broad ligament: D, ampullary; E, ovarian; F, abdominal pregnancy; A.C., abdominal cavity; B.L., broad ligament.

The ampullary variety may abort into the abdomen, or may rupture into the abdominal cavity or into the broad ligament.

Ovarian pregnancy will rupture into the abdominal cavity.

From a practical point of view, tubal pregnancy may be considered at various stages:

(1) Before rupture.

(2) After rupture into the abdominal cavity.

(3) After formation of an encysted blood tumour.

(4) After rupture into the layers of the broad ligament without death of the ovum, or into the abdominal cavity with a similar result: the latter is extremely rare, *i.e.* secondary pregnancy.

Cause of tubal pregnancy. This is not rightly known. It was formerly believed to be due to absence of cilia from the tubes. Many observers consider it to be due to faulty or absent peristalsis in the tube.

Rubin has proved by experiment that peristalsis does occur. That inflammation plays a large part in its occurrence is fairly certain. There is nearly always a history of sterility or of one child sterility, which is often accompanied by a definite history of gonorrhoea. We believe from our experience now that tubal pregnancy is caused by an inflammatory process which interferes with the normal migration of the fertilised ovum into the uterus, and that this inflammation causes an absence of some of the cilia as well as interfering with the normal peristalsis of the tube.

Anatomy and course of a tubal pregnancy. The ovum gets embedded by the trophoblast into the wall of the tube in a somewhat similar manner to the uterine implantation. As there is a shortage of stroma cells in the mucous membrane of the tube, there is practically no decidua formed, although a certain amount of decidual reaction occurs: the ovum therefore embeds itself in the muscle. It is probable that the muscle offers little resistance to the eroding process of the trophoblast, and it is found to disappear gradually in the region of the insertion of the ovum. In addition to the trophoblast, oedema, haemorrhage, degeneration pave the way for rupture to occur. As the decidual formation is practically absent, separation of the ovum readily takes place with haemorrhage strictly comparable with the separation which precedes abortion.

While this is going on, a definite decidua is formed in the uterus, and this separates at the time of commencing rupture of the tube, and it is this separation which causes the *external haemorrhage.*

Various sequelae may follow tubal pregnancy.

(1) It may rupture very early into the abdominal cavity (extra-tubal rupture).

(2) It may rupture into the tubal lumen (intra-tubal rupture).

(3) The ovum may die, become absorbed and surrounded

by blood clot, and follow exactly the same sequence of events as in carneous mole (tubal mole, see p. 251).

(4) The rupture through the tube may be partial, and may become surrounded by blood clot (para-tubal rupture). It may continue living and later invade the broad ligament with or without death of the ovum, and cause the formation of a pelvic haematoma.

(5) It may be aborted (tubal abortion) into the abdominal cavity, where it usually dies, or it may persist as a secondary abdominal pregnancy, or it may be aborted as far as the tubal ostium, become surrounded by blood clot, when the condition is known as peri-tubal rupture, although not a rupture in the strict sense of the word. In this case the ovum is nearly always dead.

Tubal abortion and tubal rupture often cannot be diagnosed clinically. Sometimes the former occurs without any marked clinical phenomena; at others, the same symptoms as those of rupture are present. Tubal rupture results in the following way: the trophoblast erodes, there is softening, degeneration, and haemorrhagic infiltration of the muscle; and the growing ovum distends the tube, so that the tube ruptures, commonly in the second or third lunar month of pregnancy, or even before this. Two-thirds of the tube are enclosed by peritoneum and one-third by broad ligament tissue. In about 75 per cent. of cases the tubal ovum escapes into the peritoneal cavity, and in the remainder it is extruded between the layers of the broad ligament. Severe haemorrhage may attend rupture, rapidly leading to the death of the patient, and this is most common when rupture occurs into the broad ligament, as the large vessels are involved. This is especially the case when the blood escapes into the peritoneal cavity. Less haemorrhage leads in the first group of cases to a collection of blood in Douglas's pouch, a *pelvic haematocele;* in the second group to a collection of blood between the layers of the broad ligament, a *pelvic haematoma.* A smaller amount of haemorrhage may scarcely affect the patient constitutionally, but may permit of the escape of a living and partly separated ovum, either into the *peritoneal cavity*, or between the layers of the *broad ligament.* In the former case the ovum con-

tinues to live in a false sac formed by bowel, omental and peritoneal adhesions; at full term spurious labour sets in and results in the death of the foetus. In the latter case the foetus continues to live in a false sac formed by the layers of the broad ligament. Then, usually about the fifth or sixth lunar month of pregnancy, either the sac ruptures with *severe* haemorrhage, in marked contrast with the initial rupture that has such a slight constitutional effect on the patient that it excites no alarm; or else the foetus continues to live to full term, when spurious labour sets in and the foetus dies.

Any of these results may be preceded by minor haemorrhages, which make the patient pale and give her

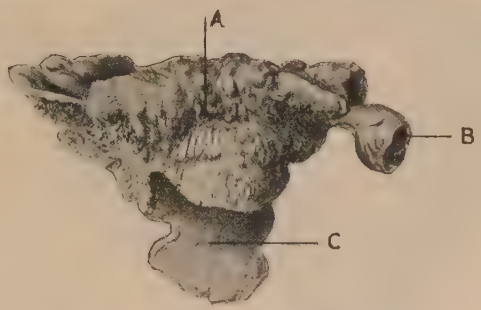


FIG. 137.—Decidual cast of the uterus. A, shaggy external surface; C, smooth internal surface; B, small interstitial ovum. (Rotunda specimen.)

griping colicky pains in her lower abdomen. Practically, as already observed, they can be classified into the four following groups, and they will be considered separately with regard to their special points.

1. **Tubal pregnancy before rupture.** Irregular haemorrhage from the uterus following a varying period of amenorrhoea, often not longer than a fortnight, is the usual sign that causes the patient to seek advice. Sometimes she comes because of colicky pains. These pains are probably due to violent peristaltic action in the tube, set up by the presence of the growing ovum (Tottenham). She may or may not think she is pregnant, and the fact that irregular haemorrhage may occur almost from the start, confuses any menstrual history. She may have morning sickness, and her breasts may be full, and these suggest pregnancy.

Thus irregular haemorrhages in a married woman, especially when accompanied by colicky pains, are signs of importance and should suggest the necessity for making a vaginal examination. The haemorrhages are due to gradual and imperfect separation of the uterine decidua, which is formed at the same time as the tubal pregnancy. More rarely, a complete cast of decidua is expelled from the uterus. It may be expelled before rupture, though more commonly it is expelled at the time of rupture. A complete cast looks like a little triangular jacket with three holes in it, one at the os internum and one at the mouth of each Fallopian tube. It

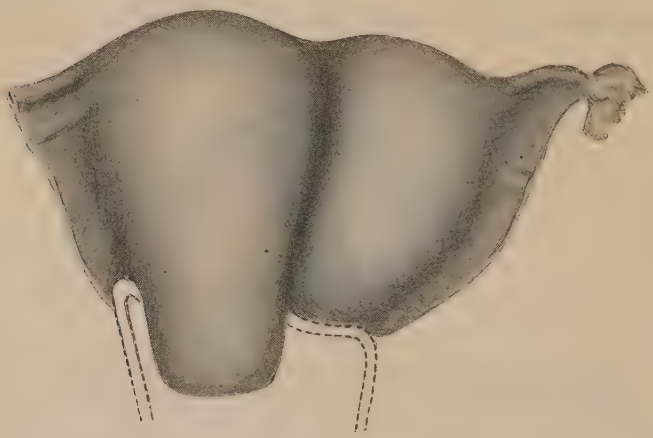


Fig. 138.—Tubal pregnancy as felt by vaginal examination.

is smooth on one surface and shaggy on the other. This cast is expelled with pain and uterine haemorrhage. The patient may keep it to show, thinking she has had an abortion. It is strong, but not conclusive, evidence of tubal pregnancy. In addition to this haemorrhage, and the expulsion of decidual membrane, she will sometimes complain of sudden colicky pain in the lower abdomen, which may be so severe as to make her sick and faint. Always be on guard against tubal pregnancy when a married woman complains of an altogether unexpected attack of colicky pain which made her pale, sick, and faint with sweating.

Therefore, if the patient comes complaining of haemorrhage, or a sudden attack of colicky pain of an unexpected nature,

it is wise to make a bimanual examination. The need of doing so is still more imperative if there is any reason to think she is pregnant.

Diagnosis of unruptured tubal pregnancy by bimanual examination. There is a *tender*, elastic lump either behind or to the side of the uterus. Pulsation may be felt over it, but the ovarian vessels will often be felt if there is a tumour lying behind them. This tender swelling is separated from the uterus by a groove (see Fig. 138). The uterus itself is a little larger than normal, and the cervix may be beginning to get soft. This softening, however, is seldom observed.

The most important and possibly the most difficult differential diagnosis is from a pregnant uterus in good position. As we have already pointed out, there is a groove in the uterus in the early months, and this sometimes makes the diagnosis difficult. Also the uterus has different consistence in various parts and may sag to one or other side. A golden rule should be followed in all cases of suspected ectopic, to make bimanual examination under anaesthesia. In this way an unnecessary laparotomy may be avoided.

The diagnosis from an ovarian cyst may present some difficulties, but this is of little moment, for no harm will be done by an operation in either case. If, however, a diagnosis must be made between extra-uterine pregnancy and a small ovarian cyst, then the matter is more difficult, for as a rule there is no necessity to open the abdomen in pregnancy when complicated by a small cyst. The symptoms and signs of these two conditions are often so similar, especially when there is threatened abortion, that it may be necessary to open the abdomen in any case, for it is more dangerous to leave a case of tubal pregnancy unoperated on than to operate for a small cyst with pregnancy. This difficulty is very apparent when it is realised that in threatening abortion with cyst there will be the history of missing a period, slight haemorrhage accompanied possibly by pain, and on examination an enlarged soft uterus with a swelling to one side will be apparent. Other differential diagnoses are pyosalpinx, small fibroid, and retroverted gravid uterus.

The diagnosis from pyosalpinx in theory is very simple,

for with it there will be pyrexia, history of infection, regular menstruation, and the swelling will probably be bilateral, while in *ectopic* in theory there will be no pyrexia, no history of infection, irregular menstruation, and the swelling will be unilateral. In practice there is usually some fever and there may be a history of infection in ectopic, while in some cases of old standing salpingitis there may be no pyrexia, the menstruation may be irregular, and then menstruation may be regular and heavy.

Biochemical analysis may be of assistance, for the urobilinogen test may be positive in ectopic gestation and the sedimentation rate slow, while in salpingitis the urobilinogen test may be negative and the sedimentation rate rapid.

For the student, the differential diagnosis may be summed up :

	Ectopic.	Pyosalpina.
Pyrexia.	More often absent.	More often present.
Menstruation.	Irregular.	Regular.
History of infection.	Absent.	Present.
Urobilinogen test.	Positive.	Negative.
Sedimentation rate.	Slow.	Rapid.

It is a matter of fact that if tubal pregnancy is suspected from the history and bimanual examination, it will nearly always be found to be present at operation.

It may be thought that the patient has only a threatened abortion, but this blunder will be avoided if a vaginal examination is always made when a woman consults a physician on account of haemorrhage.

A retroverted gravid uterus may be mistaken for a tubal pregnancy, but under anaesthesia the absence of a swelling to the side of the uterus will be demonstrable.

If an attempt is made to anteflex a tubal pregnancy, under the belief that it is a retroverted uterus, it is extremely likely to cause rupture with immediate, dangerous, and perhaps fatal, haemorrhage. This applies to mistaking a pelvic haematocele for a retroverted gravid uterus, where similar distinguishing signs apply.

Treatment of a tubal pregnancy before rupture. All obstetricians are now agreed on the treatment of tubal

pregnancy before rupture. It is to perform a laparotomy as soon as possible, and to remove the ovum with or without the tube. Removal of the ovum with the tube is the operation most commonly performed, as it is thought unwise to leave what may be an unhealthy tube, but there are some cases where it is obvious that the ovum may be removed and the tube stitched up; when this is possible it should be done.

Every care should be taken to ensure asepsis. A table that gives the Trendelenburg position is a great convenience

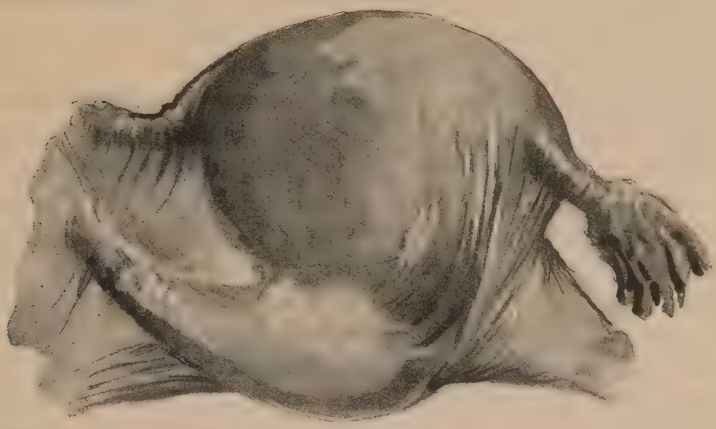


Fig. 139.—Tubal pregnancy.

but not a necessity. The preparation of the patient is similar to that described for Caesarean section (see p. 598). Avoid giving the patient a large enema.

A three-inch incision is made, opening the abdomen in the medial line down to the pubes. A gloved hand is passed down behind the uterus, when the swelling can be determined. If necessary, draw the uterus up by forceps or by a stitch passed through the fundus. After this the tumour can always be easily felt, and it may be drawn up and out of the abdomen with the hand. A ligature at each side secures the vessels, and the broad ligament is severed on both sides of the tumour. The broad ligament pedicle is now severed and the raw surface oversewn. The ovary from which the ovum escaped can be recognised, as it contains the corpus luteum of pregnancy. It is very important

to save the ovary and the other tube with its lumen intact, and so provide for future pregnancies.

For ligatures catgut or fine silk is employed.

2. **Ruptured tubal pregnancy leading to severe internal haemorrhage.** Rupture of a tubal pregnancy is likely to lead to the death of the mother from internal haemorrhage. There is no need for further emphasis on the necessity for immediate laparotomy when tubal pregnancy is diagnosed before rupture. Death may follow rupture with great rapidity. We know of a lady who, whilst putting up her hair, turned pale and faint. Her husband put her back to bed, and she died within half an hour. Such cases are by no means uncommon.

Diagnosis of ruptured tubal pregnancy with internal haemorrhage. Rupture usually takes place during the first three lunar months of pregnancy. We have seen a severe and nearly fatal haemorrhage two weeks after missing a period, but the secondary rupture from within the layers of broad ligament may take place any time during the later months of pregnancy, usually, however, before the sixth lunar month. Secondary rupture in these cases corresponds clinically with ordinary primary rupture, for the rupture that led to the original escape of the ovum was not accompanied by sufficient haemorrhage to kill the ovum, that is to say, the haemorrhage and symptoms due to it were slight.

In these cases there may be a history of some weeks of pregnancy, with perhaps colicky pains and irregular slight haemorrhage. But the outstanding point in diagnosis is the sudden onset, in a woman apparently healthy, of the signs of internal haemorrhage. There may be practically no physical signs on bimanual examination until the clot is found, which may be felt in any or all of the fornices.

The patient becomes very white, is in great pain, and is collapsed. The symptoms of collapse are given elsewhere (see p. 293). A little blood and possibly a decidual cast may have escaped from the vulva, but the signs of haemorrhage are out of all proportion to this loss, for the external haemorrhage is due simply to separation of uterine decidua. The patient's pulse is very soft and rapid, and her temperature subnormal. The blood poured into the peritoneal cavity or

stretching the layers of the broad ligament is the cause of the severe pain, and for a like reason she may have vomiting, hiccough, and hard abdominal muscles.

It may be possible to detect dullness in the flanks when there is much effusion of blood.

She is in great anxiety about herself, and if she is near death she will be restless and try to get up from the bed. If the patient be not in any immediate danger, and the obstetrician wishes to confirm his diagnosis, the urobilinogen test can be done (see p. 730).

Treatment when there is haemorrhage threatening death. There is but one treatment, and that is immediate laparotomy. Some advise waiting until the patient has recovered from shock. But during this interval more blood may be escaping, so that, even if the patient is moribund, we advise an immediate operation. It is better to operate immediately on a kitchen table than in an hour in an ideal operating theatre. The operation is an easy one.

The operation. The preparations are made as quickly as possible, and the steps of the operation down to opening the abdomen are similar to those for unruptured tubal pregnancy.

When the peritoneum is incised, the abdomen, which is full of fluid and clotted blood, literally overflows, and occasionally the foetus floats out on the blood. This free flow of blood is apt to be disconcerting, but is of no importance at this time. Without waiting to wash away any blood the hand is plunged down to the uterus, which is pulled up into the incision, and the tube is clamped by sight. The hand is then passed over the tumour to the infundibulo-pelvic ligament, which is also clamped. By this means the bleeding is controlled.

Efforts should be next made to treat the patient for collapse (see p. 293) while the operation is being finished. It is usually very severe, and although there may be a considerable amount of blood free in the abdomen, the quantity is not always sufficient to account for the serious state of the patient, which we consider is partly due to the reabsorption of blood that has undergone some alteration. The shock is most pronounced while the actual oozing continues over the already clotted blood.

All the blood which is easily seen and found is cleared out of the abdomen with the hand, but excess of time must not be taken up removing blood in great detail.

When the pelvis is cleared, the patient is put in the Trendelenburg position to give a clear view of the field of operation. Ligatures are substituted for clamps, and the operation is finished as that for unruptured tubal pregnancy.

Fortunately, however, this extreme hurry amidst unprepared surroundings is rarely called for, and required only in those cases where continuous haemorrhage is quickly killing the patient. Usually there is time to prepare the patient and get skilled assistance.

The main thing to remember in these cases is :—Be sure to find and ligature the bleeding point. No drainage is necessary.

Interstitial pregnancy is very rare. When present, it either dies and gives rise to a swelling to the side of the uterus, or it ruptures into the abdominal cavity with very severe if not fatal haemorrhage.

We have had a case lately in our practice. The treatment when diagnosed is to remove it. Some re-section of the uterus may be necessary in this, *i.e.* the pregnancy and a portion of the uterus are removed, and the raw surface oversewn. Haemorrhage may be controlled by Bonney's clamp and ring forceps on the ovarian vessels; while the use of a round-bodied needle prevents haemorrhage from the uterine wall.

3. **Ruptured tubal pregnancy leading to an encysted blood tumour.** Sometimes the bleeding due to a ruptured tubal pregnancy is not so severe as this. The patient may have some pain and be a little pale, but her symptoms at the time of rupture may not even be urgent enough for her to send for medical aid. More frequently, however, urgent symptoms arise, but they may not frighten the patient sufficiently to send for the doctor. She may think she has had a severe attack of indigestion. There is some vaginal haemorrhage as well, from separation of decidua. She recovers from her feeling of faintness, but in a day or two she becomes feverish, and still has hypogastric pain. She then sends for her physician.

On making a vaginal and bimanual examination, if there has been time for some of the blood to clot, a solid or semi-solid tumour will be felt, either behind the uterus in Douglas's pouch, or to the side of the uterus, between the layers of the broad ligament. If the blood has not clotted, either Douglas's pouch bulges the posterior vaginal wall, or the blood in the broad ligament bulges the lateral vaginal wall. The tumour caused by blood within the peritoneum is called a pelvic haematocele, that by blood outside the peritoneum a pelvic haematoma. A haematocele forms in a few hours, and the pelvis and abdomen are occupied by a hard tumour dome-shaped below, irregular and ill-defined above, reaching up towards, or even to the umbilicus. Often the uterus, elevated out of the pelvis and pushed against the abdominal wall, can be separately palpated. The patient may say she thought herself pregnant, but the usual signs of pregnancy will probably not be present.

The condition present will be either a peri-tubal or a para-tubal condition.

Never mistake a pelvic haematocele for a retroverted gravid uterus, for if this is done, and an attempt is made to replace it, rupture of the haematocele with death of the patient may result. Distinguish by two signs: (1) the uterus in pelvic haematocele is pushed up against the pubic bone or a little to one side; (2) although the cervix is pushed against the pubic bone, the anterior vaginal wall is not stretched.

Treatment. When a pelvic haematocele or haematoma forms, the ovum is practically certain to be dead.

There are two methods of treatment: one is expectant, the other operative.

Expectant treatment. Keep the patient in bed and attend to the normal functions of the body. At first she may have pain, for which opium in some form may be given. She will often turn a sallow colour, frequently has fever, feels weak, and has a bloody vaginal discharge. Whilst she has fever keep her on liquid diet. Give laxatives, if they are needed. Eventually during this treatment the blood clot absorbs and the patient gets well, but it may take several months. Occasionally make vaginal examinations

to see that the tumour is shrinking and not increasing. Sometimes it alters very little in size.

There are distinct disadvantages of this treatment. The time required for it is long, and is apt seriously to harm a woman's estimate of her own strength, and to make her an invalid. The blood may be infected and an abscess form, which is either opened, or else bursts into the vagina, the bowel, the rectum, the bladder, or the peritoneum; results which are obviously undesirable.

Nor is it always easy to tell when suppuration is occurring, for without suppuration fever is frequent. If the patient gets worse from day to day instead of better, suppuration is very likely taking place. Leucocytosis, particularly polymorphonuclear leucocytosis, strongly suggests pus, if present after the first week following the haemorrhage. The normal leucocyte count is about 9000.

On the whole, therefore, we recommend operation: and operation is imperative (1) if the tumour increases in size, or there are other signs of further bleeding, such as attacks of pain accompanied by pallor or fainting; (2) if difficulty in urinating occurs from pressure of the blood tumour; (3) if suppuration occurs.

Operative treatment. When operation is decided on the steps are the same as those described on p. 269.

When pus has formed, it is better to open the abscess from the vagina. Open by an incision in the vaginal wall, after the vagina has been well douched. Make the incision about an inch long through the bulged vaginal wall. It will be possible to do this by inserting a posterior speculum, the patient being in the cross-bed or gynaecological position. Put a pair of bullet forceps on the posterior lip and steady the cervix whilst making the incision. Insert one finger into the abscess and clear out the breaking-down clot. Douche out the cavity either with cyllin (ʒss to O j) or warm saline, under low pressure, having the can or jug not more than two feet above the table. Lightly pack the cavity with iodoform gauze and leave it in for twenty-four hours. Next day, without anaesthesia, again lightly pack the cavity, and continue this treatment daily until the abscess cavity has contracted and disappeared. This process is usually

completed in a comparatively short time. Warm vaginal douches keep the vagina clean.

4. **Ruptured tubal pregnancy, in which the ovum survives and continues to live either between the layers of the broad ligament or in the abdominal cavity.** The former has already been described.

Abdominal pregnancy either as a primary or secondary condition is very rare. The former is extremely difficult to prove, although there is a case on record where a woman became pregnant after total hysterectomy, where the ovaries had been preserved. The survival of the foetus in the abdominal cavity does occur. When this happens, the placenta usually gets attached to the great omentum, the foetus survives until full term, a spurious labour sets in, the foetus dies and a fresh decidua may be thrown off. It is seldom that the condition is recognised until full term. The foetus may shrivel, macerate, or become hardened by deposition of calcium salts into a *lithopaedion*. A woman has been known to carry a lithopaedion for forty years, but this is a very unlikely occurrence. Sooner or later the foetus and foetal sac become infected, and suppuration occurs. The abscess may burst into the peritoneum and cause death from general peritonitis. More commonly it bursts into the bowel, bladder, uterus, or vagina. In any case it leads to continued irritation and discharge of pus. It exhausts the strength of the patient, and ultimately proves fatal by either toxaemia or lardaceous disease.

Treatment. When diagnosed, the abdomen should be opened, and the foetus and placenta removed: the earlier in pregnancy it occurs, the less severe will be the operation. If it is not discovered until term, it has been advised to wait until the baby is dead. We do not concur in this statement, for there is a grave danger of suppuration. In the two cases we have met, laparotomy was done, the foetus and placenta were removed, and all bleeding points controlled. A small drain was inserted: both patients recovered. It has also been suggested that the placenta should be brought to the edge of the wound and allowed to come away in the course of time: the fatal results with this treatment have been too many to induce us to advise it.

CHAPTER XIII

HAEMORRHAGES (*continued*)

ANTE-PARTUM HAEMORRHAGE

By this term we mean haemorrhage in the last three lunar months of pregnancy; it is divided into **accidental haemorrhage,** and **unavoidable haemorrhage** or **placenta praevia.**

The main features about these conditions are that the child is viable, and that the active bleeding is due in most instances to separation of the placenta.

With our present knowledge it is quite difficult to determine the category under which to place accidental haemorrhage. A large percentage of the cases is due to *toxaemia,* therefore it could be placed with clarity in the chapter on this subject, but as haemorrhage is a predominant symptom, and as the student will expect to find it in the section on haemorrhage, we make no further excuse, but proceed to discuss both accidental and unavoidable haemorrhage.

The former is said to be present when bleeding occurs with the placenta in its normal position. The latter occurs when the placenta is partially or completely in the lower segment of the uterus.

The division of the uterus into an upper contractile and a lower expansile segment has already been discussed (see p. 91). The point, however, must be emphasised that the upper segment consists almost entirely of muscular tissue, while the lower segment is thin and fibrous, containing sparsely scattered muscular fibres. There seems but little to be gained by repeating the explanation of the formation of the lower uterine segment. Let it be sufficient to state that when the placenta is situated above Bandl's ring, the haemorrhage may be styled accidental—when below, unavoidable.

ACCIDENTAL HAEMORRHAGE

The **aetiology** is much under discussion, and in order to understand this very important part of the subject it must be taken to a large extent with the pathology. It may be divided into (1) non-toxaemic, (2) toxaemic.

In the first variety there is usually a history of trauma, but accidental non-toxaemic haemorrhage may occur without this history. In order to understand the aetiology, the conditions found at autopsy must be considered. It must also be remembered that whereas the haemorrhage is apparently secondary to the albuminuria in most instances, the possibility of the albuminuria being secondary to autolytic processes arising in the dying placenta (Young) must not be lost sight of.

Non-toxaemic. This haemorrhage is due to separation of the placenta to a small or large degree. In parenthesis it may be stated that the word "ablation" has been coined instead of separation. It is a word for which we have no use, and seems to be invented to make the subject more difficult. Trauma *may* play a part in the separation, but trauma without some pathological condition in the uterus must be of great degree to cause separation. Any condition that leads to an unhealthy decidua may cause an unhealthy or diseased attachment of the placenta. Hence, endometritis, nephritis, alcoholism, syphilis, mental shock, all render a pregnant woman more liable to premature separation of the ovum, thus leading to abortion, miscarriage, or accidental haemorrhage. A fall, therefore, or some similar accident may determine the separation, but disease must be always the predisposing factor. A definite mechanical reason such as excessive shortness of the umbilical cord or traction on the membranes during prolonged labour is occasionally found.

Toxaemic. There are various theories as to the origin of the haemorrhage in this class of case.

(1) Arguing on the hypothesis that placental separation in the third stage of labour is due to effusion of blood into the spongy layer of the placenta, it has been suggested that

accidental haemorrhage is due to a premature hyperaemia of this layer.

(2) Excessive friability of the placental tissues as a result of toxaemia may cause separation.

(3) Bearing in mind the fact that excessive swelling of the endothelium of the vessels of the uterus is a marked feature, that loss of arterial endothelium may occur with transudation of blood through the vessel walls, it is easy to visualise a flow of this escaped blood through the uterine muscle towards the placental site which may cause haemor-

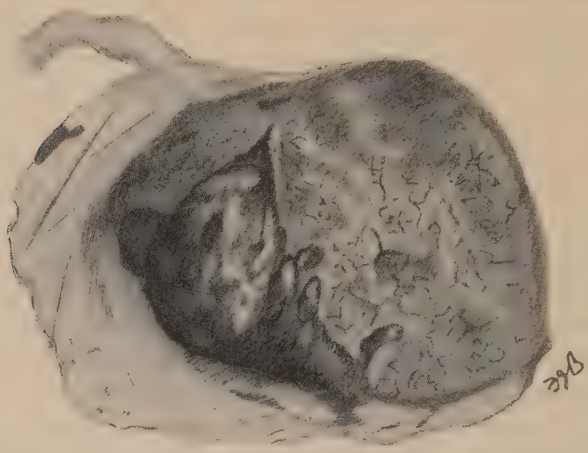


Fig. 140.—Placenta from case of accidental haemorrhage, showing clot. (Rotunda specimen.)

rhage behind the placenta, and may form a haematoma which not only separates the placenta, but makes its way into the very substance of it. This point is well shown in Fig. 140.

(4) That there is a disintegration of the muscle fibres with haemorrhage between them. This interferes with the contractile power of the uterus : gradually this haemorrhage may increase and bleeding may occur into the connective tissue and uterine cavity. Haemorrhages also occur in the decidua, even into the amniotic cavity, and the foetus usually dies. This occurs from a variety of circumstances, primarily from the separation of the placenta.

To sum up the sequence of events. Excessive swelling

of the endothelium with endarteritis and transudation through the vessel walls occurs: this blood causes disintegration of muscle fibres with haemorrhage which collects behind the placenta: a clot of variable size is formed, which separates the placenta. Part of this clot may become embedded firmly in the placenta, but the remainder comes away with the after-birth.

We believe that separation occurs whether the disease is non-toxaemic or toxaemic, that the method in which it occurs in the latter has been described above, that the

FIG. 141.—Section of uterine wall. Accidental haemorrhage. *a*, muscle; *b*, blood.

haemorrhage which is seen at the vagina is chiefly serum which has been squeezed like the juice from an orange out of the uterus from between the muscle bundles and out of the blood clot, and that clots may escape with this blood-stained serum.

The type of toxin which causes accidental haemorrhage has yet to be found out: it is certainly different from that of **eclampsia** in most instances. It is allied to it in some. In other words, eclampsia and eclampsism may be accompanied by an accidental haemorrhage, concealed or revealed, but it is more usual to find an accidental haemorrhage in very different circumstances, that is, while eclampsia is a disease largely of primigravidae, accidental haemorrhage is

a disease of multiparae. While albuminuria is present in both, fits are the predominant feature of the one, haemorrhage of the other. In spite of this dictum, however, one meets sometimes a patient suffering from accidental haemorrhage with definite eclamptic facies, etc.

The **pathological** conditions found must be briefly enumerated at this stage. For more minute details the student is referred to text-books on Pathology.

Uterus. It is large and shows evidence of superficial haemorrhages. Section of the muscle shows haemorrhage of varying degree. The muscle bundles show active necrosis. There is perivascular oedema and leucocytic infiltration, followed by cloudy swelling of the muscle fibres. Haemorrhages between the muscle bundles, and separating them as described above, are apparent (see Fig. 141).

Vessels. The changes have already been described.

Liver. Is enlarged and fatty.

Kidney. Shows parenchymatous degeneration.

Apart from these changes, the post-mortem appearances in a typical case are similar to those described in a typical case of toxaemia (see p. 199).

Varieties of accidental haemorrhage. The two varieties, **non-toxaemic** and **toxaemic**, have already been referred to. In former editions we used to divide accidental haemorrhage into **concealed** and **revealed.** This is an unsatisfactory classification, for both occur together on most occasions, that is, a revealed haemorrhage is nearly always accompanied by haemorrhage which does not escape, and which is either in the uterine wall, between the muscle bundles, in the broad ligaments, or even escaping on the peritoneal surface of the uterus: in addition, it may be found in the cavity of the uterus. Every case of revealed accidental haemorrhage usually, if seen early enough, is one of concealed haemorrhage, which later becomes revealed when the uterus becomes active as a result of labour being induced by the foreign body, *i.e.* blood clot. So long, therefore, as it is understood clearly that the haemorrhage is nearly always *mixed*, then we may proceed to make a diagnosis and discuss appropriate treatment depending on whether the haemorrhage is chiefly external, or whether it shows itself

by symptoms of internal haemorrhage. With that proviso we may now proceed to discuss the two conditions.

Concealed accidental haemorrhage.

Definition. This may be defined as an accidental haemorrhage which leads to sufficient loss of blood to cause constitutional symptoms without any or only an insignificant quantity issuing at the vulva.

Reason why the blood does not escape. There are five reasons usually assigned for concealment of accidental haemorrhage. The blood may be retained behind the placenta owing to the firm adhesion of the placental margin. It may burst through the membranes and surround the foetus, or the fixation of the presenting part in the lower uterine segment may prevent its escape. Possibly, too, the blood may be effused between the uterine wall and the foetal membranes, and be retained by the firm adhesion of the membranes to the internal os. But what is actually found in concealed accidental haemorrhage is a feeble and flabby uterine muscle, the result of degeneration. It used to be thought that as the blood was poured out, this muscle yielded—that the uterus ballooned before the advancing blood—that if the uterus were healthy, the blood would escape, but that the unhealthy condition of the uterus allowed it to yield. It is also possible that paralysis of the muscle has been brought about by absorption of poison generated in freshly effused blood over old blood clot, and that the condition of the uterus (not in labour) favours absorption. Tone in muscle is necessary for retraction, and it is this loss of tone which may partly lead to concealment of the haemorrhage. These last theories are not altogether practicable. A more likely theory, with our present knowledge, is that bleeding really does take place between the muscle bundles, due, as already stated, to degeneration of the muscle fibres: this allows a continuous haemorrhage which in time will cause constitutional symptoms, and which will also in time allow a certain amount of blood to appear at the vulva.

The cases which show pronounced concealment of haemorrhage are nearly always toxaemic and must be viewed with great anxiety.

To sum up the possible reasons why blood does not escape :

(1) Blood retained behind the placenta.

(2) The foetus as a whole may prevent its escape.

(3) The presenting part may act like a cork in a bottle.

(4) Effusion of blood may occur between the uterine wall and the foetal membranes, and be retained by the adhesion of the membranes to the internal os.

(5) Ballooning of uterus before advancing blood.

(6) Retention of blood due to effusion between muscle bundles.

Symptoms and signs. With regard to "period of pregnancy" the patient varies. She is most likely to be at or near full term, and this serves to distinguish the condition from placenta praevia, when the patient is premature. She does not come under observation until she is in a state of extreme *collapse* from internal haemorrhage, and *shock* caused by the extreme dilatation of the uterus is present. She is white or yellowish, collapsed, thirsty, anxious, restless, sweating, yawning, with a small, rapid and even imperceptible pulse. The temperature is subnormal. She may suffer from dyspnoea. Abdominal pain may be present from distension of the uterus, which may have become very large suddenly. There may be slight haemorrhagic vaginal discharge. The blood which appears is mainly non-clotting blood-stained serum which has been squeezed out, the clot remaining : this latter sign is an excellent indication of the condition, and has been taken as a definite diagnosis of accidental as against unavoidable haemorrhage, but while we regard it as extremely helpful, we cannot take it as absolutely definite. In the toxaemic variety there is usually a peculiar oedema of brawny type. No foetal heart is audible.

The uterus is large, round, tense and tender, and difficulty will be experienced in palpating the foetal parts. The presenting part is quite likely to be fixed in the brim, thus distinguishing it from placenta praevia. The patient is usually in labour, which has probably been started by the presence of the clot. Vaginal examination reveals nothing

except the absence of a placenta, which also differentiates it from placenta praevia. Clot may be felt, and this will feel like placental tissue. If it breaks in the fingers, it is clot; if not, it is placenta. The membranes are tense. In other words, the diagnosis is made chiefly by the symptoms—to some extent by the signs. There is albumin in the urine.

Treatment of concealed accidental haemorrhage. A true case of the old-time concealed haemorrhage is extremely rare. Different obstetricians have different ideas on the subject, so that statistics are of little use. As the treatment for concealed and revealed, and for toxaemic and non-toxaemic haemorrhage are so alike, they will be considered together.

Symptoms and signs of revealed accidental haemorrhage. These are very similar to those of concealed. The symptoms, however, are not so marked. The amount of collapse varies with the amount of internal haemorrhage and the amount of blood lost by the vagina. That is, in a true case of **concealed** haemorrhage the uterus is very distended, foetal parts will be difficult to feel, the woman will be in a profound state of collapse, there will be no external bleeding. When the haemorrhage is mixed, the collapse symptoms will vary, the uterine distension also will depend on the amount of internal haemorrhage taken in combination with the external haemorrhage, while in a true case of revealed haemorrhage the case will be obvious. There will be little or no abdominal distension, no symptoms of internal haemorrhage, and the actual symptoms will depend entirely on the amount of blood seen at the vulva. In other words, common sense must be employed to decide whether the case is *revealed*, *mixed*, or *concealed*. The mixed variety is the most common, and both the mixed and revealed are really later stages of the concealed, although the revealed may be a primary condition.

Treatment of any variety. We have changed our views very considerably with regard to the treatment of accidental haemorrhage. We have in the past advised plugging the vagina as the treatment *par excellence* in nearly every case: we have argued in the past with those who have advised such minor measures as rupture of the membranes. We

now review our experience. We believe we have saved patients who would have died if the vagina had not been plugged : in the same way we believe we have saved patients by Caesarean section, but while we do not feel (on the rare occasions on which we have done the latter operation) we have done it unnecessarily, we believe there have been occasions on which plugging the vagina has been done unnecessarily. We have found lately that simple measures get the best results, but we always have our plugs ready to combat the resisting case. Caesarean section is seldom if ever necessary.

Our **present routine treatment** consists of treating the collapse and stopping the haemorrhage. The former is difficult : the latter usually stops with little effort. In order to outline our treatment let us take a typical case. A patient is brought under our observation who has lost blood and is still losing : the abdomen is tense but the foetal parts are only just distinguishable. The pulse rate is 120, temperature 98° F. She is pale and anxious. The case is a common case of accidental haemorrhage of the mixed variety, chiefly revealed. The treatment is summed up as follows :—Treatment of collapse by immediate transfusion of saline solution under the breasts, injection of pituitary extract ·25 c.c., which may be repeated every half-hour until 1 c.c. is given, unless the blood pressure is high, rupture of the membranes with the application of a tight binder. The prophylactic treatment of collapse is in our opinion the most important part of the treatment. In every case of accidental haemorrhage, saline solution should be given, the amount depending on the pulse rate, etc. One pint under each breast is a safe and rational amount. The best method of doing this and of other means of treating collapse will be referred to later (see p. 293).

Submammary saline is preferred to intravenous, because it is simpler for the general practitioner who will be called on to treat most of these cases. The intravenous method may be quicker, but simplicity is the keynote of success in obstetrics. The same applies to blood transfusion.

Other methods of treating collapse must also be called to aid. We believe that labour should be brought on in

nearly every case of true accidental haemorrhage. Pituitary extract ·25 c.c. will help to cause the uterus to contract. Rupture of the membranes will do the same: it will help in the collapse, and it will reduce the size of the uterus. That is, pituitary extract with rupture of the membranes and the application of a tight binder will probably aid in starting labour. Once the membranes have ruptured, the patient *must be carefully observed.* On any sign of quickening of pulse rate the saline must be repeated: in a bad case, intravenous saline should be given and possibly a donor should be ready so that transfusion may be done. What is the progress of the labour? The baby may be born very quickly, or twenty-four hours may elapse. Preparations should always be made for the occurrence of post-partum haemorrhage—although we have seen it but seldom lately—that is, the douche can should be ready with large Bozeman's catheter, gauze for plugging, etc.

This is what has been found to occur on most occasions: that is what *will* occur in the practice of most obstetricians, but atypical cases are bound to happen and the doctor must be ready for them.

What are these atypical cases?

The haemorrhage may continue with continuation of signs of collapse, in spite of the treatment outlined above. In this eventuality the vagina should be plugged. We have not, however, met a case of this kind in recent years. The exact method of plugging is described under operations (see p. 566).

As already stated, our routine treatment is "submammary saline, rupture of membranes, pituitary extract." In spite of meeting many serious cases, we have had no mortality in the last two years.

Are there any other possible modes of treatment, and should they ever be employed?

(*a*) **Leaving the patient to go to term.** This treatment is very seldom but is occasionally indicated. The typical instance in which it may arise is as follows:—The woman is twenty-eight weeks pregnant, has a *small* haemorrhage which stops. All constitutional symptoms are absent. What is the doctor to do?

Provided her blood count is not too low (2,500,000–

3,000,000 R.B.C.), and provided there are no other biochemical or clinical indications, she may be given tonic treatment; she should be observed carefully, when she may go to term or to near term to be delivered of a strong baby. This type of case *does* arise, and discretion and experience must be used to decide on treatment or temporisation. When in doubt the membranes should be ruptured.

(*b*) **Induction by sea-tangle tents** and hydrostatic bags. Occasionally the former is good treatment. For example—a woman who is *very premature* is seen who has had a haemorrhage which caused a rapid pulse rate. The haemorrhage ceases, the rapid pulse rate continues. She is under observation, and for three days bleeding continues *slightly*. Something must be done. The cervix is tightly closed, the pulse rate is slightly faster, 90–100. If the haemorrhage is *slight* as described, induction by *tents* is good : if it is marked and increasing, plugging the vagina or some of the other treatment may be indicated. Prophylactic submammary saline must always be remembered.

While hydrostatic bags are used in some places, we do not recommend them. The method of introducing them is described on p. 564. These treatments are seldom indicated.

(*c*) **Abdominal Caesarean section.** Owing to the very unfavourable statistics with this operation we have discontinued this line of treatment.

(*b*) **Vaginal Caesarean section.** The same remarks apply to this as to the abdominal operation.

(*c*) **Accouchement forcé.** This form of treatment is completely out of date, and should never be employed.

Prognosis and after treatment. The prognosis in these cases is comparatively good, provided details are followed.

The after treatment consists in—(1) treatment of the anaemia consequent on the haemorrhage; (2) careful treatment of the kidney condition; (3) advice as to abstinence from pregnancy unless the nephritis is cured; (4) treatment of any abnormal uterine condition such as endometritis.

Special note should be taken of the fact that the patient should be treated for the toxaemia during labour, *i.e.* starvation, water, etc. treatment should be carried out.

How to rupture the membranes. The best technique to follow in this operation is :—

With the patient in the cross-bed position, the external genitals are cleansed and a vaginal douche is given.

The half hand (left) is placed in the vagina with two fingers in the cervix; the membranes are then punctured with a long stilette, retaining the hand in the vagina while the liquor amnii drains away.

To sum up Accidental Haemorrhage.

Diagnosis chiefly from placenta praevia.

(1) Tense uterine wall.
(2) Difficulty in feeling foetal parts.
(3) Fixation of presenting part.
(4) Blood chiefly serum.
(5) No placenta felt by the vagina.

Varieties. I. Concealed. Revealed. Mixed.
II. Non-toxaemic. Toxaemic.

Causes. Theories have been already advanced. The chief cause is toxaemia.

Best treatment is rupture of membranes, pituitary extract, the treatment of collapse, especially the prophylactic treatment.

Vaginal plugging may be necessary on very rare occasions.

PLACENTA PRAEVIA OR UNAVOIDABLE HAEMORRHAGE

When bleeding occurs in the last three months of pregnancy, it is either due to accidental haemorrhage or placenta praevia. The former has already been considered.

When bleeding in the last three months of pregnancy is caused by the separation of a placenta situated either wholly or in part in the lower uterine segment, the condition is known as **unavoidable haemorrhage**, and the placenta is termed a **placenta praevia.** It may be very large and thin—a placenta membranacea.

Three varieties are described.

(1) **Central.** When the placenta covers the os completely, when the whole of the lower segment is covered by it, and when its margin cannot be reached by the finger (see Fig. 142).

(2) **Marginal or partial.** This partially covers the os and part of the lower segment is covered by it (see Fig. 143).

(3) **Lateral.** The edge can be felt just above the internal os, *i.e.* it is in the lower segment above the internal os (see Fig. 144).

Aetiology (see Figs. 145, 146). Various theories have been suggested to explain placenta praevia, and most of them have something plausible in them.

(1) That the ovum after fertilisation is inserted in the

Fig. 142.—Central placenta praevia.

Fig. 143.—Marginal or partial placenta praevia.

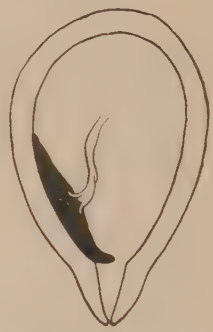


Fig. 144.—Lateral placenta praevia.

lower uterine segment instead of in the body of the uterus. This theory is called the basal implantation theory. The placenta is attached to the decidua basalis and the clinical result is a central placenta praevia.

(2) The placenta is developed in connection with the decidua capsularis (the capsularis implantation theory) instead of with the decidua basalis. As the ovum grows larger, union between the basalis and capsularis takes place, and the placenta becomes partially attached to the lower uterine segment. This variety will probably be either a lateral or marginal placenta. Fig. 146 will help to illustrate this.

(3) Defective vascularity of the decidua is supposed to help in causing placenta praevia by reason of the fact that the placenta has to spread over a larger area for nourishment.

(4) Inflammatory or atrophic changes in the placenta can be explained in the same way.

(5) The large thin **placenta membranacea,** because of its size, must spread over a large area and may invade the lower segment.

(6) The large flabby uterus of multiparity may predispose to the condition.

(7) The presence of fibroids may distort the shape of the uterus and may cause a low implantation.

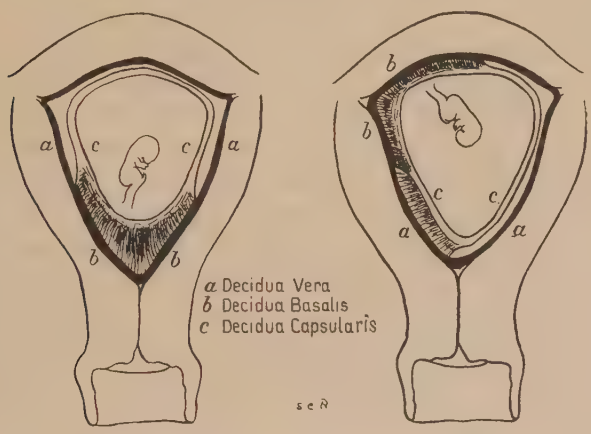


FIG. 145. FIG. 146.

Diagrams to explain formation of placenta praevia.

(8) Secondary low implantation of a detached high implanted ovum.

Why does the placenta become detached in the last three months of pregnancy ?

(*a*) The most likely reason is that the painless contractions which go on during the whole pregnancy cause a passive dilatation of a lower segment which is softer and more dilatable than normal.

(*b*) Disease of the placenta may cause separation—this is rare.

(*c*) The fact of the decidua capsularis being concerned abnormally in union with the placenta may prevent the attachment from being as firm as usual—detachment may therefore occur easily.

(*d*) Normally the lower uterine segment expands in preparation for labour during the later months of pregnancy, and the placenta does not expand with it, and must therefore become detached—this is the most generally accepted theory.

1. Dangers of Placenta Praevia.

To the mother.

Collapse from haemorrhage may occur: we have met in our private practice cases of complete collapse (absence of pulse at the wrist, etc.) following haemorrhage from a placenta praevia. This collapse leaves the patient in a desanguinated condition, far more prone to *sepsis*. Sepsis may also occur because of the low position of the placental sinuses. Both collapse from haemorrhage and sepsis will leave her in a very anaemic state, and more subject to diseases of all kinds, including menstrual abnormalities. In addition, rupture of the uterus at the time of labour may occur because of the soft and sodden condition of the lower segment. It has also been suggested that this sodden condition is due to the defective decidua, which offers less resistance to the encroachment of the trophoblast, which will be found in some cases to have eaten through the uterine wall.

To the child.

Prematurity is very common, and death during the first month is consequently over 50 per cent.

Death from separation of the placenta may occur, or **death** from injury to the placenta in manipulations to stop the haemorrhage.

Signs, symptoms, and diagnosis. The first sign of placenta praevia is external haemorrhage. The bleeding may occur during sleep. There is no pain, for the contractions of the uterus during pregnancy are not painful; hence the patient may not even wake up. The bleeding may be slight or it may be fatal before the doctor can get to the house. There is one thing certain, that if slight bleeding occurs, and this bleeding is due to placenta praevia, the bleeding will recur, and probably in so severe a form that it may be fatal, therefore treatment is necessary immediately the condition is diagnosed in nearly every case.

An effort has been made in some centres to teach that the *absolute* diagnosis of placenta praevia can be made without making a vaginal examination. While much help can be got, and a probable diagnosis made, the absolute diagnosis can only be made by a vaginal examination, and we only classify cases in our statistics in which the placenta has been felt on vaginal examination.

How can the diagnosis be made? The patient is going about her work, or she may be asleep, when a severe painless haemorrhage occurs: she is pregnant from seven to eight months. The haemorrhage is very "clotty" (unlike the serum which is most usual in accidental haemorrhage).

Palpation reveals either a malpresentation or an unfixed presenting part: this is due to the occupation by the placenta of the lower uterine segment. A **vaginal examination must next be made.** The foregoing symptoms have suggested placenta praevia, so that everything should be in readiness for treating the condition at the time the vaginal examination is being made. Under every aseptic precaution, two fingers are passed up to the cervix: if the placenta is *central*, a spongy thick substance is felt by the fingers. If the placenta is not central or partial, the fingers must be passed up to the internal os to feel if a marginal placenta is present. The manipulation must be carried out gently to avoid bleeding. This mass (placenta?) must be diagnosed from blood clot, and this can be done only by ascertaining the fact that clot breaks up between the fingers—placenta does not.

Helpful, but not certain signs, should be looked for before passing the finger into the cervix—one lateral fornix may seem full: there may be markedly increased pulsation in the fornices.

If a patient has been treated as for accidental haemorrhage, and when the os is more open the margin of a placenta is felt, she must be treated as for placenta praevia.

The treatment of Placenta Praevia. At the Rotunda Hospital the treatment adopted in most cases is version.

The treatments in vogue are given, and will be considered separately.

(1) Bi-polar version.
(2) Rupture of the membranes.
(3) Hydrostatic dilators, *e.g.* Champetier de Ribes bag.
(4) Traction on the head.
(5) Plugging the vagina.
(6) Caesarean section.

We still believe that the best results are obtained by bringing the half breech down on the placenta; therefore, unless the breech is the presenting part, we turn.

If the os admits two fingers, bi-polar version is done. If it admits the hand, we prefer internal version. If it is fully dilated and there are indications, either we perform version and extraction or we extract with forceps. This treatment is best for many reasons. The general practitioner can practise it: it is safer than most other methods for the mother. Except in the case of central placenta praevia, it is nearly as safe for the child. The method of performing version is given in the chapter on obstetrical operations (p. 586).

When version has been performed through a two-finger os, the **patient is left to deliver herself.** The foot having been brought through, a piece of gauze is tied to it. Should bleeding continue, *slight* traction is made on the leg: if necessary, a half-pound or one-pound weight is tied to it. The bleeding will always cease. *On no account should extraction be done through the unopened cervix, for disaster will surely follow.* The cervix tears like wet blotting-paper, and rupture of the uterus into the uterine vessels will inevitably ensue.

If slight haemorrhage continues after version gentle *traction* on the foot should be done, which will always effect a stoppage unless the cervix has been torn: in that case a plug of gauze should be placed by the side of the heel. The time which elapses before delivery occurs after version is very variable. From two to four hours is the average, but this may be extended even to twenty-four hours.

After version has been done, or even while preparations for version are being made, about two pints of *saline* are given under the breasts. This is a most valuable prophylactic. The preventive treatment of collapse is just as

important in this as in accidental haemorrhage. If labour should last long after version, it may be necessary to repeat the saline. Venous transfusion may be considered, but is seldom feasible. The other treatments for collapse may also be necessary.

Preparations should be made for post-partum haemorrhage, which, in our experience of recent years, has seldom occurred.

Rupture of the membranes. This treatment alone is seldom indicated. It may be done in the case of a high lateral or marginal placenta praevia when the os is *fully* open. Even then the patient must be watched carefully. It may be done in selected cases—women with slight haemorrhage—but when in doubt do version.

Hydrostatic dilators. The one in most common use in these countries is that of Champetier de Ribes. In America, that of Voorhees or one of its modifications is chiefly in use. We do not favour them here. It is suggested that the infantile mortality is less with this form of treatment than with version, while the maternal mortality is the same. Statistics quoted to prove these facts are open to grave objection. The disadvantage in general practice is that it may not be available in the rare case of placenta praevia when it may be encountered, and even if to hand it may be out of order, for these bags are very liable to get stuck together or to be otherwise not available when required. We believe, too, that the placing of a large foreign body in the uterus is liable to set up sepsis.

The indications and method of inserting the bag are described on p. 564.

Traction on the head. This is a method of treatment which we have tried on a few occasions. It has been suggested by Willett, who uses a forceps with a grasping portion three-eighths of an inch long which carries two teeth. The handles are seven and a quarter inches long. To use the forceps, the placenta must not cover the cervix completely and the os must admit one finger. It is claimed that the forceps can be used to grasp the head without causing further injury than a cephalhaematoma, and that a weight attached to the forceps exerts pressure on the

placenta which stops the haemorrhage. We feel that this method is a possible alternative to version, but the present forceps is too short, and we have modified it by increasing its length to 12 inches.

Plugging the vagina. The method of performing this operation is described on p. 566. It is very seldom indicated for placenta praevia. In the very rare case where the cervix is not large enough to admit two fingers and the bleeding is severe, the vagina must be plugged. We have had to do this on a few occasions.

Caesarean section. The vogue for this operation as a treatment for placenta praevia has increased enormously. Many consider it the one and only treatment, but there are many disadvantages. It should *always be done* for a primigravida with a central placenta praevia, who is not far off term, and who has had very little internal manipulation. If the baby is very premature it should not be performed. There is no doubt that the prognosis for the baby is better with Caesarean section than with any other treatment, but the baby is often so premature that this major operation is contraindicated, or else the patient is so placed, as in a small country house without conveniences and too far from hospital to be removed, that its consideration is impossible.

It means very often—once a Caesarean always a Caesarean.

The operation we prefer is the low segment variety, owing to the risk of infection, but the classical operation may be done when the case is absolutely clean.

It should be done where contracted pelvis is present in addition to the placenta praevia, or sometimes if severe toxaemia is an accompaniment.

Generally speaking, then, we recommend—Caesarean section in some few selected cases. For the general practitioner who requires a practical line to guide him, bi-polar version *without immediate extraction* embraces a treatment most suitable to the majority of his cases.

On the very rare occasions when the cervix is either closed or admits only one finger, plugging the vagina is indicated.

In addition, we must remember the prophylactic and curative treatment of collapse.

Prevention of further attacks of Placenta Praevia. We always advise curettage about two months after an attack. We believe this is rational, for the endometrium is often at fault. We have had many patients pregnant, with normal confinements, after placenta praevia.

To sum up the differential diagnosis and treatment.

	Accidental Haemorrhage.	Placenta Praevia.
Parity.	Multipara.	Occasionally primigravida.
Toxaemic symptoms.	Nearly always present.	Usually absent.
Period of pregnancy.	Varies.	Nearly always premature.
Pains.	Present.	Absent.
Abdomen.	Tense. Presenting part fixed.	Slack. Malpresentation or non-fixation of presenting part.
Foetus.	As a rule dead.	Alive at commencement of haemorrhage.
Haemorrhage.	Continuous loss of blood-stained serum.	Clots. Repeated gushes.
Treatment.	Prophylactic saline. Puncture membranes. Tight binder. Pituitary extract.	Prophylactic saline. Bipolar version.
Course of case.	Rapid spontaneous delivery.	Spontaneous delivery: generally 2 to 4 hours.
Convalescence.	Recovery fairly rapid because toxaemic condition improves after delivery.	Recovery slow because symptoms are due chiefly to loss of blood—not toxaemia. Liability to sepsis.

Collapse and Shock

Collapse is best defined as the condition which immediately arises from a sudden loss of blood, *i.e.* it is due to loss of fluid.

Shock denotes a graver condition, in which the tissues have undergone a profound alteration because of interference with the blood circulation.

Collapse is evidenced by restlessness, air hunger, and sighing respiration. The lips become blue and the aspect of the face changed. There is great anxiety, semi-conscious-

ness and profuse sweating; the heart is irregular, tumultuous in its movements, and the pulse rapid, thready and compressible. The lowered blood pressure brings about a diminished loss, or perhaps complete cessation of the bleeding. Should this favourable result ensue, the patient's condition quickly improves, and the vessels again fill from an in-flow derived from the fluid in the surrounding tissues. Such recovery may be followed by recurring haemorrhage, and the patient's condition is then apt to become one of shock.

When haemorrhage occurs in any locality, immediately on escaping from the vessels or capillaries the blood appears to undergo a radical change, and will if reabsorbed give rise to a rapid toxaemia, resulting in collapse, or shock. Thus in such conditions as haematemesis, haemoptysis, haematocele, haematoma of the vulva, and concealed accidental haemorrhage, the shock is always out of all proportion to the actual loss of blood. It is apparently during the interval that elapses between the effusion of blood and its coagulation that the toxic substances are formed, for blood that has clotted is comparatively innocuous. The shock is worst when oozing persists and the absorption is continuous, particularly when the oozing occurs over clotted blood; thus blood injected under the skin of an infant rarely appears to cause shock. One of the most marked characteristics of shock is the almost universal relaxation of the unstriped muscles (this is possibly true of the striped as well); there is wide dilatation of the pupils; the anus, intestines, bladder, and even the facial muscles are relaxed, so that the cheeks puff in and out during respiration. When this symptom is associated with a grey aspect and much altered facial appearance death is not far distant.

The skin surface is moistened and deathly cold, and at first the heart can barely make a pulse wave appreciable at the wrist, but when the arteries dilate, the pulse becomes rapid, easily compressible, and increasingly difficult to feel, until finally it is altogether lost. Probably the veins (particularly the abdominal) partake of this dilatation, and contain much blood, otherwise it is rather difficult to account for the emptiness of the arteries in the early stages.

This engorgement has never been demonstrated in shock, but if these veins were dilated, their increased capacity would make them appear to contain little blood, even though the amount present was more than their normal content.

The passage of the blood stream through the arteries and veins is slowed, there is a great relaxation of the skin capillaries, and in the latter the blood stagnates. The vessels no longer hold the fluid portions of the blood, and most of the plasma escapes into the surrounding tissues; that which remains becomes thicker. The accumulation of carbonic acid and the curtailment of oxygen greatly embarrass respiration and induce an acidosis. It has been observed on many occasions that in the state of shock the uterus dilates; whether this dilatation occurs in every case or not it is difficult to say; that dilatation is a frequent accompaniment of adherent placenta is undoubted, and further it is found to precede rather than follow the general state of shock. It is a familiar observation that if the uterus fills up with blood after the child is born, the obstetrician, after having rubbed up the uterus to a contraction and expressed the clots, notices on looking at the patient that she is suffering from shock to some extent. What has happened is that by the pressure of the hand some of the free blood that was contained in the cavity, or in the uterine wall, has been forced back into the general circulation and caused a rapid toxaemia. The shock is not due to the loss of blood in the clots that have been expressed, since this blood was already in the uterine cavity, and therefore lost to the maternal system. If haemorrhage should occur into the uterus before delivery (concealed accidental haemorrhage) and the conditions are such as to favour its rapid re-absorption, shock will occur, associated with dilatation of the uterus, in the course of which further haemorrhage follows.

Before dealing with the treatment it is well to be reminded of certain facts which characterise the condition. (1) Neither blood nor saline can be retained within the vessels of a patient suffering from deep shock. (2) Venous infusion, when injected too rapidly, or in too large quantities, may cause acute dilatation of the heart, the muscle of which

is already disordered because of deficient circulation. (3) Collapse is not primarily due to a weak heart, and as strychnine cannot increase the rapidity of circulation, it may prove positively harmful. Adrenalin should also be avoided, for great congestion of the liver and blocking of its circulation are apt to follow as a secondary result of its use.

Efforts have been made to procure a fluid more perfectly isotonic than that provided by salt and water, and one that will be held better in the blood vessels. For this purpose a modified Ringer's solution may be employed—

Sodium Chloride	gr. xc.
Potassium Chloride	gr. iv.
Calcium Chloride	gr. iij.
Water	O j.

Gum solution from two to six per cent. has been found to be a very valuable addition to the saline solution injection. Finally, remember that shock may arise quite independently of haemorrhage: may be induced by fright, pain, or by the vigorous treatment which has to be undertaken for the cure of many obstetrical complications.

The **symptoms and signs** of collapse consist of—

1. Anxiety and restlessness on the part of the patient.
2. Air hunger.
3. Sighing respiration.
4. Extreme pallor.
5. Marked coldness of the limbs, which are sometimes covered with a clammy perspiration.
6. A rapid, weak, thready pulse which may be difficult to feel at the wrist.

The **treatment** is carried out with a view to remedying these conditions. Fluid should be given to the patient to compensate for its loss; warmth is applied. These are the two great principles of collapse treatment which will now be outlined.

Order of treatment in a typical case.

1. Raise the foot of the bed so that the blood tends to run to the vital centres of the brain. Do not waste time looking for suitable blocks. A box or a chair answers very well.

2. Bandage the legs and arms, beginning at the ankles, so that the blood will gradually be squeezed into the central blood systems. Apply warm stupes to the heart and adopt every means possible to keep the surface of the body warm. Hot-water bottles wrapped in flannel should be placed around the patient and warm blankets over her.

3. Hot drinks are given if she is conscious, and if she is severely ill, inject hypodermics of 20 minims of brandy and then of ether. Camphor in oil c.c. i is useful. Pituitary extract c.c. i and ernutin c.c. i or femergen in post-partum collapse are given as a routine.

4. Infuse two pints of saline solution under the breasts. The strength is ʒj to the pint, and the temperature about 105° F. We believe that this is a more practical method of giving fluid to a collapsed patient than the intravenous method of blood transfusion, for any practitioner is able to carry a submammary apparatus and to give it, while the intravenous method is more difficult and requires greater care in asepsis. If, however, the patient is very severely ill, the intravenous method is quick and satisfactory.

In addition to giving fluid in this way it is wise to inject half a pint of coffee at a temperature of 105° F. by the bowel. Whisky ℥ ss. may be added.

Venous infusion. If possible, use water that has been boiled, and tabloids for normal saline. But if not, use ordinary tap water, warmed by the addition of water from the kettle, and ordinary table salt, sterilising the salt by boiling in a little water. There is not time to wait whilst a quantity of boiled water cools. A scalpel, probe, and infusion apparatus will be needed. There is no need for an anaesthetic, as the patient is too ill to mind pain. Bare one arm and tie a bandage, or better still place a piece of rubber tubing round the middle of the arm to compress the superficial veins but not the brachial artery. This makes the median basilic and median cephalic veins stand out just at the bend of the elbow. The median basilic is the larger vein, but the brachial artery lies directly under it, therefore the median cephalic is safer. We always choose the larger median basilic. Expose it by cutting along the skin over it for about an inch. Put the probe under it and move the

probe up and down, so as to free the vein. Pass a piece of fine silk underneath it. Fill the infusion apparatus with saline, holding the needle up to expel all air. Kink the tube to stop the flow. Cut through the anterior wall of the vein with the knife and insert the needle. It is known if it is in the lumen of the vein and not between the coats of the vein wall by the ease with which the needle slips in. Tie the needle in with the catgut and ligature the vessel below the canula. Cut the bandage round the arm, and holding the funnel of the infusion apparatus about two feet above the patient's arm, let the fluid run in slowly, allowing about fifteen to twenty minutes for the two pints to enter the circulation.

Take out the needle or canula, tie the vein above and below the wound in it with fine silk, cut these ligatures short and sew up the skin with salmon-gut. The canula may be left in the veins if preferred, so that small quantities of salt solution may be run in from time to time. Any temporary dressing, such as a clean handkerchief tied round the elbow, will suffice until proper dressings are obtained.

Transfusion of Blood

If direct transfusion be preferred to infusion with salt solution it is best carried out by one of the following methods.

Direct method. In this an artery of the donor is connected with the cephalic vein of the receptor by means of a glass tube bellied in the centre and drawn to a fine extremity at each end. It is steeped in liquid paraffin, and before use all surplus paraffin is removed. Whilst the blood flows from the artery to the vein, the outside of the glass is kept warm by means of a constant stream of hot water. This plan has many obvious disadvantages, and at present it is not as generally employed as the indirect method.

Indirect or Weil's Method. One half-pint of blood is drawn from the cephalic vein of the donor into a warm and sterile glass bowl by means of an aspirating syringe. Whilst the blood is flowing there is continuously added to it a 10 per cent. solution of citrate of soda, in the proportion of 1 part of the solution to 10 parts of blood. In this way the blood is prevented from coagulating, and it should, as soon

as possible, be injected into the recipient's vein. If time permits, the blood of the donor should be tested with that of the recipient, and if the serum of one agglutinates the corpuscles of the other, it proves that the blood is not suitable. If it is impossible to apply this test, it is well to inject a small preliminary quantity of blood a few hours before the

Fig. 147.—Infusion of breasts.

main mass, and thus to determine by an absence of reaction that the bloods are not unsuitable.

It is evident that this blood infusion can seldom be made applicable to the emergencies of Obstetrics, and our main reliance must still be placed on isotonic saline solution.

Infusion into the breasts. Cleanse the skin at the lower edge of the breasts with tincture of iodine. Fill the infusion apparatus with fluid. Pick up the breast with the

hand and plunge the needle deeply into the tissues under the breast. It is best to use an infusion apparatus with double tubes and needles and infuse under both breasts at the same time. Infuse one pint under each breast. The fluid takes longer to be absorbed than by venous infusion. Cover the puncture wounds with an aseptic dressing. Massage the breasts gently to hasten absorption. The disadvantage of infusion into the breast is, that the fluid does not go directly into the circulation, but it is a simpler operation and is therefore preferred by us.

5. After infusion, inject a pint of strong coffee into the rectum.

6. Finally, if the patient's condition does not rapidly improve, resort to artificial respiration and oxygen inhalation. The benefit resulting from artificial respiration is often considerable.

Infundibular (pituitary) extract raises the blood pressure and keeps it raised for some hours. In profound shock it is of great value, particularly when used in conjunction with saline infusion. Ernutin, when injected intravenously, also raises blood pressure, and acts as a stimulant, but it is said to be less efficient than pituitary extract.

Recurrence of symptoms. The pulse always improves after venous or submammary infusion, but it may quickly flag again. When it begins to flag, it is a warning that secondary collapse is about to supervene. Therefore infuse one more pint into the breasts, and repeat the pituitary extract. This may be necessary within half an hour of the first infusion. Give another injection of ether hypodermically. Sit by the bedside of the patient and watch her carefully. It may be necessary to treat a third occurrence of collapse, but prepare against this by injecting a pint of hot saline high up into the rectum half an hour after the second infusion. It is better not to leave the patient until the pulse has become strong and steady.

CHAPTER XIV

PREGNANCY ABNORMALITIES. DISEASES IN CONNECTION WITH THE DECIDUA AND OVUM

DISEASES OF THE DECIDUA

THERE is little known about this subject, for specimens are difficult to obtain. Williams describes four varieties:

(1) Hyperplastic endometritis, which includes general hyperplasia, localised hyperplasia, and polypoid growths.

(2) Glandular hyperplasia.

(3) General hypoplasia.

(4) Acute and subacute endometritis (inflammatory changes).

It is believed that these arise before pregnancy, and most of them are so rare that a mere mention of them is sufficient.

The last is believed to be due to attempts at criminal abortion. Glandular hyperplasia is, however, an exception to this, and its synonyms, *Endometritis catarrhalis* and *Hydrorrhoea gravidarum*, especially the last, will convey to the mind of the reader the condition which is present.

Symptoms of Hydrorrhoea gravidarum. A watery discharge, which may or may not be tinged with blood, flows from the pregnant uterus. It is thought to be due to a catarrhal endometritis with excessive activity of the glands. The decidua capsularis does not meet and unite with the decidua vera until the end of the third lunar month of pregnancy. The space between them is known as the chorio-decidual space, and it is from the decidua lining this space that the fluid is supposed to come. In hydrorrhoea this space is thought to be kept open by the fluid throughout pregnancy.

The continuous dribbling of fluid distresses the patient, and she has always to wear a napkin. In the later months

of pregnancy the fluid sometimes collects in the uterus, and then comes away in gushes, accompanied by uterine contractions. The patient not unnaturally thinks that the waters have broken, and she is going to have a miscarriage. These gushes may be repeated during the later months of pregnancy.

Diagnosis. In the early stages, hydrorrhoea has to be distinguished from abortion, vesicular mole, or extra-uterine pregnancy. This can be done by making a bimanual examination. The fluid that is discharged, when abortion is threatening, or when there is extra-uterine pregnancy, is not watery, but is pure blood. In the case of vesicular mole it may be watery, but it does not stiffen linen, whereas the fluid of hydrorrhoea gravidarum does.

In the later months the condition has to be distinguished from premature rupture of the membranes. The nature of the fluid will not aid. The other signs of labour are absent, and there is the history of previous dribbling of fluid; moreover, the membranes are found by vaginal examination to be intact.

Treatment. No treatment is of any avail. There is no danger to the mother, and she may be reassured about herself. She will often go to full term, although the discharge continues. Six weeks after labour the patient should be treated for endometritis.

DISEASES OF THE CHORION

These were dealt with in the last chapter. Hydatidiform mole has been dealt with in the chapter on Moles.

DISEASES OF THE AMNION

Hydramnios

This condition, which is also called Polyhydramnios, is an excess of liquor amnii. The normal amount is about two pints, but symptoms very seldom arise even if the amount reaches five pints. When above this quantity symptoms are usually present, and the excess varies to an alarming degree, seven and eight gallons having been measured in our practice.

Causes. The source of the normal amniotic fluid is unknown. It is possibly foetal in origin, although some investigators have attributed it to the mother. The causes are, therefore, divided into—

(1) **Maternal causes.** (*a*) Transudation from the maternal vessels. (*b*) Disease of the heart and kidneys. (*c*) Syphilis has been suggested, but we believe it is present with hydramnios as an accidental complication.

(2) **Foetal causes.** (*a*) Foetal urine. Although believed to be a very common if not the usual cause, this cannot be consistently true, for in early cases, such as those arising in the very early months, it is impossible. However, with monovular twins, when one child obtains a greater share of blood, hypertrophy of the heart and kidneys may arise—a condition of affairs which is naturally followed by increased secretion of urine. Schiller has stated that the amniotic fluid has its source in the action of the foetal urine on the amniotic epithelium: the former actuating the latter to secretion. (*b*) Torsion of the cord causing increased transudation from the umbilical veins. (*c*) Inflammation of the amnion with formation of fluid. (*d*) It has been suggested that liquor amnii is secreted in the normal individual, and that polyhydramnios may be due to increased secretion and deficient absorption.

If none of these theories is acceptable, it must be taken to be foetal in origin in most instances, in view of the enormous number of abnormalities associated with it, *e.g.* hydrocephalus, anencephalus, spina bifida, talipes, etc.

Time and nature of onset. It is most usually found between the twenty-fourth week and twenty-eighth week of pregnancy, but may be found earlier or later. The former is uncommon. We have lately had in our practice a patient who was only just in her fourth lunar month. The onset may be acute or chronic, *i.e.* the patient may notice that she has suddenly (in a day) become enormous in size, or else that her abdomen has during a month gradually assumed its enormous proportions.

Symptoms and signs. These are due entirely to the enormous size of the abdomen, which may arise not only from the excess of liquor amnii, but also from the fact that

twins, especially monovular twins, may be present. The patient suffers from pressure symptoms, owing to the increased size of the uterus. These are aggravated when the onset is sudden. She has great difficulty in breathing, and has to be propped up by pillows at night. Her circulation is impeded, her lips are blue, and her hands and feet are cold and blue. Her legs swell. She has indigestion and vomiting. Albumin often appears in the urine.

If the formation of the fluid is slow, the system gradually accustoms itself to the increasing size of the uterus, and we have ourselves measured twenty-six pints of amniotic fluid, which came from a woman who did not show serious symptoms of pressure.

On **inspection** of the abdomen it is found larger and rounder than normal.

Palpation reveals a fluid thrill. It is impossible sometimes to detect the outline of the stretched uterus. Foetal parts are difficult to detect, and movements cannot be felt.

Auscultation. The foetal heart is inaudible: fluid is a bad transmitting agent for sound.

Vaginal examination. Distinct ballottement even at full term can be distinguished: the cervix may be open before labour starts owing to overstretching by the membranes.

X-ray examination. If there is any doubt of the diagnosis, an X-ray examination will confirm it.

Differential diagnosis. (1) *Twins.* This may be extremely difficult, as the two conditions coexist so often, but a marked excess of fluid is readily diagnosed.

(2) *Ascites.* There will be a history of renal or other constitutional disease: the well-known symptoms of ascites will be present: there will be no ballottement on vaginal examination. Foetal parts will be distinguished.

(3) *Ovarian cyst.* This will probably be to one or other side: the methods of diagnosis will be found in any gynaecological text-book. If the cyst is associated with pregnancy, the uterus and the cyst will be easily separable in most instances, and a pedicle may be felt by the vagina.

(4) *Full bladder* will be diagnosed by emptying it.

(5) *Pseudocyesis.* Phantom pregnancy will disappear when a whiff of chloroform is administered.

(6) *Hydatidiform* mole (see p. 255).

Results. The overstretched uterus often discharges its contents before full term, and so premature labour is common. During labour the presenting part is not grasped by the lower uterine segment, and the foetus floats in the liquor amnii. Sudden rupture of the membranes may be accompanied by extreme shock. The rush of fluid may carry down with it the part of the foetus nearest the internal os. Malpresentations and prolapse of the cord, therefore, are common. The overstretched uterus contracts badly, hence labour is slow, and the delivery of the placenta may be delayed. The absence of proper contraction and retraction favours the occurrence of post-partum haemorrhage.

Treatment. If the disease occurs early in pregnancy, *i.e.* before the child is viable, labour must be induced, for there is no use allowing a woman to carry an enormous quantity of liquor amnii, with no likelihood of a live child, a moment longer than is necessary.

If the pressure symptoms are severe and the woman's life is threatened, the uterus must be emptied. Moreover, the only justifiable way of inducing labour is by rupturing the membranes. If hydramnios is discovered when the patient is in labour—for the os is always open owing to the pressure of the fluid—the membranes should be ruptured in the manner to be described, in order to control the rush of liquor amnii.

How to rupture the membranes in hydramnios. Put the woman in the cross-bed position and empty her bladder. An anaesthetic is not necessary. Cleanse the hands and the external genitalia, as before a vaginal examination, and have a sterile catheter ready.

Lubricate the gloved hand with soap and pass the whole or half hand into the vagina. Pass the forefinger into the cervical canal and through the internal os, which will always be opened sufficiently to permit its passage. Pass it between the membranes and uterine wall. Then taking the catheter stylet in the other hand, run it up along this finger into the uterus. Scratch through the membranes

with its point as high as possible in the uterus. By this high puncture the outflow of fluid is controlled. A sterile towel over the wrist also aids in controlling the flow. The contracting uterus presses down on the hole in the membranes, and lessens the outflow of fluid. Another method of control is to keep a hand in the vagina. The vagina contracts round the hand, which acts as a plug and allows the fluid to run out slowly. Allow as much fluid to escape as is thought necessary when labour is present. When the patient is in the recumbent position and the labour pains are absent or slight, sufficient fluid will remain in the uterus. Make certain that either the breech or vertex presents and that the cord is not prolapsed. If any abnormal presentation, or prolapse of the cord, is present, treat it according to prescribed rules. Keep the woman in bed. Labour, very probably, will start within twenty-four hours, and the child be delivered naturally.

If it does not, is there any indication to act? Generally if labour does not start within twenty-four hours, a rise of temperature occurs: this is indicative of infection in the uterus, and something must be done: even if there is no rise of temperature, labour should be assisted at this stage. The best method is to perform version if a head present, grasp a foot in the case of a breech and bring the half-breech to the cervix as in placenta praevia. Labour will soon start after a tight binder has been applied. Apart from version, the insertion of a hydrostatic dilator has been suggested: it is unnecessary as a rule, and means if anything more handling and therefore more chance of sepsis.

Sometimes it is possible to diagnose hydramnios in the upper sac of twins: sometimes it is not.

If present in the upper sac, the membranes of the first should be ruptured. When the first child has been delivered the second sac is treated as already described.

Other abnormal conditions of the amnion are cysts and inflammations.

Oligo-hydramnios

More rarely there is a diminution in the amount of amniotic fluid. The results to the mother are that the foetal move-

ments, not being checked by the liquor amnii, are more painful, and secondly that, the dilating bag of waters being absent, labour is prolonged. The results to the child are those due to amniotic adhesions, which may form when the child is in direct contact with the membranes. Amputations of the foetal limbs and other deformities may ensue. Amputations have also been attributed to winding of the cord around limbs, but a little consideration will show how impossible this must be, for even slight pressure on the cord would kill the child, and growth would cease.

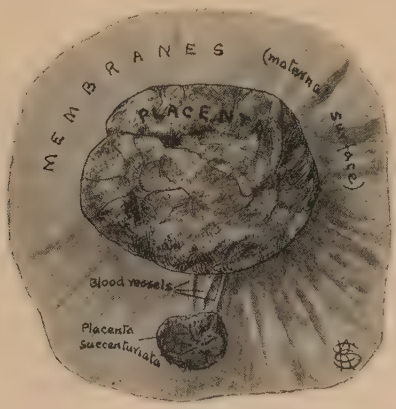


Fig. 148.—After-birth with placenta succenturiata.

It is not possible to prevent or to treat oligo-hydramnios. The presence of adhesions causing deformity of the child, and the absence of sufficient liquor amnii, are conditions which will reveal themselves.

ABNORMALITIES OF THE PLACENTA

(1) **Placenta succenturiata** (see Fig. 148). This is a small additional placenta attached by means of vessels, or else by a thin bridge of placenta bearing vessels, to the main placenta. It may occasionally be present as a placenta praevia.

Its significance lies mainly in the fact that it may be left behind and cause post-partum haemorrhage and sepsis. It is most important to recognise the existence of a placenta succenturiata, and this can be done by recognising the

vessels that feed the placenta, broken off at the edge of the main placenta. In addition, the fact that a succenturiate placenta has been left behind in the uterus is readily recognised by the opening in the membranes corresponding to it.

(2) **Placenta membranacea.** This is an unhealthy thinned-out placenta which may cause complications in labour, for it may spread down to the lower segment and result in placenta praevia, or it may become retained and cause post-partum haemorrhage.

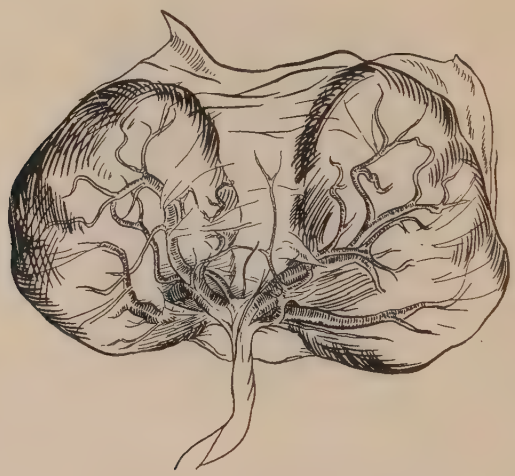


Fig. 149.—Placenta bipartita.

It is due to new supply of blood in the decidua capsularis which prevents the chorion laeve from atrophying. This allows functioning villi to cover the periphery of the ovum, which in consequence is followed by the placenta occupying the periphery of the chorion instead of being limited to the decidua basalis.

(3) **Placenta circumvallata.** In this a ridge is present on the foetal surface of the placenta, inside of which is a definite depression. This is due to extensive proliferation of the chorionic villi after attachment of the amnion.

(4) **Placenta bipartita or tripartita.** This is where there are two or three definite divisions in the placenta. An interesting point in this division is that the vessels

extend from one lobe to the other to meet and help in the formation of the umbilical vessels (see Fig. 149).

(5) **Battledore placenta.** This is where the cord is inserted into the edge of the placenta. It is often associated with velamentous insertion of the cord (see Fig. 150).

(6) **Placenta fenestrata.** This is where there is a definite window in the placenta. This " window " is usually in the centre, and must not be mistaken for a missing cotyledon.

(7) **Placenta duplex and triplex.** Where there are two or three distinct lobes.

Fig. 150.—Battledore placenta.

(8) **Placenta praevia.** Where the placenta is situated in the lower uterine segment (see p. 286).

(9) **Placenta accreta.** Polak has drawn attention to a condition in which there is an entire, or almost entire, absence of the decidua basalis, exposing the muscle of the uterine wall to the erosive action of the trophoblast and penetration of the villi. This intimate relation makes it impossible to find any line of cleavage for separation, and Polak suggests in these very rare cases that hysterectomy will be necessary.

This condition may be met with in varying degrees. Attention is first drawn to it by inability to remove the placenta from the uterine wall without the sensation that

the uterine wall is coming with it. Post-partum haemorrhage may or may not be an accompanying symptom. Efforts should be made to remove as much as possible of the placenta. The puerperium may be stormy, but the patient usually gets well without the necessity for any drastic treatment. If pyrexia persists in the puerperium accompanied by subinvolution, it may be necessary on rare occasions to perform hysterectomy, but hysterectomy in the puerperium is not advisable as a general rule. If it is quite impossible to separate any of the placenta, hysterectomy must be considered.

(10) **Abnormal weight and size of the placenta.** Normally it is between 16 and 18 centimetres in diameter, and 2 to 3 centimetres thick. It is usually about one-seventh of the weight of the child, *i.e.* a 7 lb. baby will have a placenta 1 lb. weight. The syphilitic placenta is much heavier. This is of importance in medico-legal cases, as it is a help in the diagnosis of prematurity if the baby be destroyed, *i.e.* a premature baby is much smaller in proportion to its placenta than a full-time baby.

(11) **Infarcts of the placenta.** These usually have very little significance. They may be red or white.

They may be found on either surface of the placenta, and they vary in shape.

Sometimes a condition known as placenta marginata occurs, which is caused by infarcts of varying size and number forming a white ring round its periphery.

There is a condition known as placental apoplexy, in which red or brownish areas are found distributed through the surface of the placenta. These consist of haemorrhages surrounded by a capsule.

Various theories to explain the formation of infarcts have been suggested. Inflammatory changes, blocking of the maternal vessels and an obliterative endarteritis of the vessels of the chorionic villi are all possible causal factors.

We agree with Williams and other observers who suggest that necrosis in the periphery of the chorionic villi follows interference with circulation through their vessels. The progress from this stage to the stage of

infarct is gradual. We also believe that blocking of the maternal vessels by an obliterative endarteritis accounts for some cases.

In association with infarct formation we must mention placental infection : usually the conditions are associated. Rare cases of gonorrhoeal infection of the placenta have been reported.

Tumours of the placenta. The following are described :

Fibroma.

Angioma.

Sarcoma.

Myxoma fibrosum.

Cysts of the placenta. These usually arise from the chorion and are of interest as curiosities, but, so far as is known at present, have no clinical significance.

Tuberculosis and calcification of the placenta have been seen. The latter is fairly frequent, but, like many other pathological conditions of the placenta, has little clinical significance.

Adherent placenta. See Placenta accreta and Retention of placenta (pp. 169, 309, 486).

ABNORMALITIES OF THE CORD

(1) **Abnormal insertion.** The battledore placenta has already been referred to. It is often associated with velamentous insertion (see p. 309). By this is meant that the vessels which join the cord, instead of doing so at its junction with the placenta, branch and join the cord some distance from its placental insertion.

(2) **Knots and loops of the cord.** The former are divided into true and false knots. True knots are fairly common, and may cause death of the foetus : usually, however, they are of little clinical importance. These knots are simply due to faults in development, and are not important. Loops have a somewhat similar significance to knots : they may become looped around any part of the child. Unless the loop is very tight, no harm results.

(3) **Long and short cord.** The average length of the cord is 20 inches (50 cm.). When very short, it may drag on the placenta and cause detachment : when too long, it

may become encircled around the child's neck or body and cause strangulation. It may become prolapsed.

(4) **Inflammation of the cord.** This is due in most instances to unnecessary manipulation of the cord or to carelessness in sterilising ligatures. It may be very slight, only few local signs being present and without rise of temperature, or it may be very severe with abscess formation around the cord, when it will be followed in all probability by jaundice or peritonitis. In addition to these symptoms the baby becomes extremely ill and haemorrhage from the

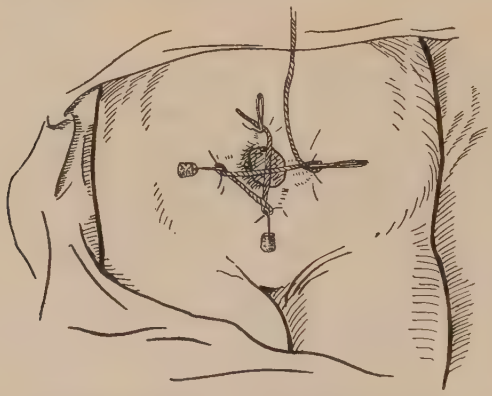


Fig. 151.—Figure-of-eight ligature for haemorrhage from the cord.

cord may result. Antiseptic dressings and hot fomentations should be applied. If an abscess forms it should be opened, and the general treatment for septicaemia should be followed if necessary.

(5) **Varicose veins of the cord** occur and may rupture.

(6) **Benign and malignant tumours of the cord** of all varieties have been reported. Teratomata, myoxomata, and sarcomata are most common.

Haemorrhage from the cord. Haemorrhage from the cord, unless due to looseness of the first ligature, is a very serious sign. The haemorrhage is either due to sepsis or haemophilia, and in either case will probably lead to a fatal result. Subcutaneous haemorrhages and melaena may accompany it.

Treatment. Put another ligature on the cord closer to the umbilicus. This usually fails to stop haemorrhage.

The next method is to underpin the umbilical vessels. Pick up the stump of the cord and pass two long needles under it from side to side. Now wind a piece of woollen thread boiled in solution of corrosive sublimate in a figure of eight about the needles and so compress the umbilical vessels. Guard the points of the needles with pieces of cork. We have several times stopped bleeding successfully by this plan (see Fig. 151).

CHAPTER XV

PREGNANCY ABNORMALITIES

GENERAL DISEASES AND PREGNANCY

Syphilis. Syphilis is the greatest known cause of abortion, miscarriage, and still-birth. It is most active as a cause of early interruption of pregnancy when the infection of the parent or parents has been recent. The investigation of parental syphilis must be carried out with tact, for any suspicion of parental immorality may bring unhappiness to a home.

Syphilis may be imparted to the ovum by the mother, when she herself at the time of conception is suffering from the disease, or when she contracts it during pregnancy. The father can transmit it to the offspring through the spermatozoon. Although the father has no infectious lesion at the time of coitus, the ovum may contract the disease although the mother escapes. Nor will she get the disease if she suckles her syphilitic infant. This exemption of the mother is termed Colles' Law. Modern investigation has shown that this law is by no means true in every instance.

The post-mortem changes by which syphilis may be recognised in a still-born child are changes in the cartilage at the junction of the diaphyses and epiphyses of the long bones and the ribs, the so-called syphilitic epiphysitis. This line, instead of being a thin, regular, blue line, becomes a thicker, irregular-edged, yellow line. Normally, it is about 0·5 mm. thick, but when affected by syphilis it is four or five times as thick as this. The liver and spleen are enlarged, are firm when cut into, and have a more translucent appearance than normal. Thus in a still-born child, the cartilages, liver, and spleen should be examined. If unable to make a post-mortem examination, or if the

child is alive, its wizened, undersized appearance, the thick skin of the soles and palms, and possibly pemphigus on the hands and feet, and dusky red patches about the buttocks, are all strongly suggestive of foetal syphilis. In all suspected cases of syphilis the foetal blood, drawn from the umbilical cord, should be collected in a vessel and sent to the pathologist for examination. The pathologist, too, will be able to discover spirochaetae in the dead foetus, or in the placenta. The signs of congenital syphilis in the living child are more fully described on p. 677.

The placenta infected by syphilis shows definite changes. It is larger and paler than normal, looks greasy and unhealthy, and is often friable and flabby. The size and flabby appearance are most characteristic. The chorionic villi, when teased out in salt solution, are thickened and club-shaped. In microscopic sections the villi are seen to be packed with small round cells and the vessels obliterated. Careful search may demonstrate spirochaetae in the placenta.

When clear indications of syphilis have been found, both parents will require treatment.

Treatment. The most satisfactory method of treatment is that of giving intravenous injections of Novarsenobillon, "914," or some allied preparation; properly controlled by the Wassermann reaction. The following routine is carried out by Kirkpatrick at Dr. Steevens' Hospital:—if the Wassermann reaction is found to be positive, eight weekly injections are given as follows:

1st week	0·3 g.	5th week	0·6 g.
2nd ,,	0·45 ,,	6th ,,	0·45 ,,
3rd ,,	0·6 ,,	7th ,,	0·45 ,,
4th ,,	0·75 ,,	8th ,,	0·45 ,,

A Wassermann reaction is now taken.

(1) If this reaction is positive, a month is allowed to elapse before commencing a second course, which is identical with the first, save that the dose need not under ordinary circumstances exceed 0·45 g. If after the second course the Wassermann reaction is positive, an interval of a month to six weeks is allowed, and then a third course given, which is similar to the second. If after the third course

the Wassermann reaction is positive no further injection should be given for at least three months.

(2) If after the first course the Wassermann reaction is negative, further blood examinations should be made each month; and even if the negative reaction persists it is advisable to give a short course (four weekly injections: 0·3, 0·45, 0·45, 0·45 g.) during the later weeks of pregnancy. If the injections cause much sickness or headache, the quantity given at each injection should be reduced; sometimes any dose larger than 0·3 g. will not be well borne. If at any time during pregnancy symptoms of syphilis should arise, the patient is treated, even if the Wassermann should be negative.

We think that if the patient be allowed to take her meals in the ordinary way she is less likely to be jaundiced as a result of the injection than if starved.

Patients who have received two courses of treatment during pregnancy are generally delivered of a healthy child; sometimes the infant's blood may be positive at birth, becoming negative shortly after. Infants in whom signs of syphilis develop within three months of birth usually do badly, whereas if the development of the disease can be staved off until after this date the prognosis is greatly improved.

The Wassermann reaction gives a valuable guide as to the condition of the mother. It is desirable to give an injection of 0·3 g. a week before taking it, a so-called "provocative dose"; it increases the likelihood of getting a positive reaction, and therefore makes a negative one of more value. Old syphilitic cases should always be treated, unless one has good reason to think that the treatment had been very thorough at the time the disease was contracted.

The earlier the stage at which the disease is treated, the better the results; thus those in which spirochaetae are recovered from the primary sore, but the blood has not yet become positive, are readily controlled; early secondary cases can usually be cured completely in a little longer time; while late tertiary are extremely difficult cases to cure permanently.

Cases in which the blood is negative, but the cerebro-

spinal fluid positive, do not do well. We do not advocate the giving of mercury in addition to N.A.B. during pregnancy, since it is apparently of little use unless pushed until the patient be salivated; this is not desirable, and further it is doubtful if even then the disease is any the more readily brought under control.

Pulmonary Tuberculosis. A woman who is tubercular should be advised not to marry : if she marries, she should be advised not to become pregnant. Sometimes tuberculous women are sterile because the tubes are closed, but more often they are unusually fertile. During pregnancy she may improve a little in her general health, but she becomes very ill after the child is born, and death often ensues.

Treatment. The patient usually carries on to full term without trouble. Strength should be sustained in every way, and tonics should be given. If labour is prolonged it should be terminated as soon as conditions for delivery are fulfilled. Labour may be made more easy by giving scopolamine morphine anaesthesia.

There are some exceptions to these rules. If the patient is seen in the first three months, and the disease appears to be advancing, or if she has acute tuberculosis, induction may be done. If a primigravida is seen late, and the disease is advanced, Caesarean section under spinal (stovaine) anaesthesia may be done. Induction of labour after placenta formation is not so successful, as tubercular disease progresses rapidly during puerperium and involution.

Cardiac disease. A woman with cardiac disease should be advised not to marry if she has presented symptoms of heart failure such as dyspnoea, cyanosis, haemoptysis, dropsy, congestion of the viscera : if the heart is enlarged and if there is auricular fibrillation (complete irregularity of heart and pulse). If the lesion is stationary and there have been no symptoms attributable to it, and if the heart is not enlarged, marriage may be undertaken with comparative safety, though it is wiser that a patient presenting mitral stenosis or aortic disease should remain unmarried. If she marries and becomes pregnant, the consideration of her case will depend on certain factors, and must be dealt with from the following points of view :

(1) The early months (first three months).
(2) The middle months (before the child is viable).
(3) The last three months.

Pregnancy with compensated heart disease. No treatment is necessary in this type of case, but the patient should be instructed to take abundant rest and to avoid all exertion which produces distress. Iron tonics are useful. She should be allowed to go to full term, when the labour should be made as easy to bear as possible. Twilight sleep may be given, and the second stage terminated when conditions are fulfilled. The patient should be advised not to become pregnant again without advice.

Pregnancy with decompensated heart disease.

(1) *First three months.* She should not be allowed to go through the strain of pregnancy. Complete rest should be ordered, and digitalis in full doses administered and continued until symptoms subside, whereupon abortion should be induced (after consultation with another physician) by means of sea-tangle tents or by dilatation and curettage. If digitalis fails in seven to ten days, the pregnancy should be terminated.

(2) *Second three months.* The same remarks apply to this period as to the first three months, unless the baby is approaching viability : if so, and it is possible to carry on, nothing should be done, and the case is then treated as in the last three months.

(3) *Last three months.* The patient should be allowed to go to term, when Caesarean section under spinal (stovaine) or open ether anaesthesia should be done. The results with induction of labour are not good, and Caesarean section offers the best chance of a successful result.

At the same time it must be stated that rapid failure, with death, may occur during the puerperium.

Nephritis. This has been already dealt with (p. 200).

Blood diseases.

Anaemia is very commonly seen during pregnancy : it is best treated by haemoglobin grs. 5 three times daily, or by injections of iron and arsenic.

Pernicious anaemia and other allied diseases are

occasionally seen and are treated as in the non-pregnant state. In very severe types labour must be induced.

Diabetes. Fehling's test frequently shows the presence of sugar in the urine of pregnant women, especially in the later months of pregnancy. This sugar may either be glucose or lactose. It is very necessary to distinguish between them, for whereas glucose is the sugar that accompanies the disease of diabetes, lactose—or milk sugar—in the urine of pregnant women can hardly be looked upon as an abnormality. The distinction between these two sugars is made either by the fermentation test by the polariscope or by the glucosazone test. Lactose reduces Fehling's solution, but does not ferment with yeast. Should the sugar be lactose, no alarm need be felt nor treatment undertaken. Should, however, the sugar prove to be glucose, its presence suggests the possibility of diabetes. The distinction between the disease diabetes and alimentary glycosuria is discussed in medical treatises, but should diabetes exist coincidently with pregnancy, the condition is generally considered to be very serious for the mother. Not infrequently diabetic coma supervenes and ends her life. Death of the child and premature labour are also common consequences. A woman with diabetes should not become pregnant : if she does, and is a primigravida, she should be allowed to go to full term. Twilight sleep should be given, but ether and chloroform increase the danger : she should not be allowed to nurse the baby. If, however, she is a multipara, the prognosis is generally bad, and labour should be induced in the early months ; Caesarean section under nitrous oxide and oxygen anaesthesia may be indicated in the later months. The absolute indication for induction is severe acidosis. Insulin must be remembered in treatment and should always be given before anaesthetics. It should be pressed. We have given up to 70 units in twenty-four hours.

The presence of acetone in quantity adds to the gravity of the prognosis. If the pulse becomes weak or rapid, saline solution is given under the breasts or by the rectum. A full diabetic diet should be given, and it is known that even with insulin the prognosis is worst during the puerperium owing to rapid alteration in metabolism.

Chorea. This usually occurs in primigravidae, but women with this disease should not marry. Cardiac disease is often an accompaniment. It sometimes occurs with other toxaemic signs : at others, no sign of toxaemia can be found. Abortion and death may occur.

Treatment. The violent movements should be controlled by sedatives (large doses of bromide). If the movements become so excessive that food cannot be ingested, abortion is induced. This sometimes, but not always, cures the chorea.

Infectious diseases. Any infectious disease may occur in pregnancy, and the baby when born may be infected.

They often cause abortion, and in the acute fevers, *e.g.* scarlet fever, the prognosis at full term when in labour is serious.

The patient's strength must be maintained, and as she is more liable to sepsis, this must be guarded against.

Nervous diseases. These are considered in the chapter on Psychoses.

Skin diseases. Herpes has been described under Toxaemias. There is another type known as Dermatitis herpetiformis, a description of which will be found in text-books on dermatology.

Pruritus vulvae may be grouped in this section. It usually occurs in very obese women and is due to sweat. It is often necessary to keep the patient in bed and apply some antiseptic dusting powder. If the pruritus is very intense, the application of milk followed by thorough drying and cocaine ointment will ease the pain, prevent scratching, and a cure will probably result. Vaginal discharges should be treated by douches, and irritative clothes should be changed.

Malaria. In these countries malaria is uncommon. Patients come from abroad with a history of the disease, and it may appear at any time in pregnancy or in the puerperium.

Treatment. We advise a prophylactic dose of quinine, 5 grs. daily during pregnancy : this dose will not induce premature labour. If the patient gets malaria, quinine,

grs. 5 three times daily, with a little Fowler's solution, may be administered.

Pyelitis. This is a very common disease of pregnancy. It is due to the bacillus coli as a rule, and this infective organism may be accompanied by an additional causal factor in compression of the ureters at the brim of the pelvis. It is most frequently seen in the last three months of pregnancy. The onset is sudden with severe pain and tenderness in *one* loin and some fever. The height of temperature is very variable and may reach 104° F. The urine is acid and contains pus. Bacillus coli or the causal organism is found in pure culture. The differential diagnosis is simple and is chiefly from appendicitis and cholecystitis. In pyelitis the pain is higher and has a tendency to change from one to the other loin.

The treatment consists of rest in bed, purgatives, milk diet, and copious drinks of water.

Sodium citrate grs. 20 three times a day may be given, and sodium bicarbonate grs. 20 every four hours until alkalinisation of the urine occurs, has been recommended. We rely chiefly on *water*.

No local treatment is necessary, and if the disease does not respond to the treatment outlined, it may be necessary to induce labour. If pyelonephrosis supervenes, nephrectomy may be necessary to save the woman's life.

Vaccines have been advised, but we do not use them in pyelitis of pregnancy.

Appendicitis. This is a complication often encountered. It is very serious in the later months. We have had to operate with the patient at full term. The symptoms are as in the non-pregnant state.

The treatment is operation in the early months. In the last two months if it can be postponed until after birth it is better, but when in doubt, operate then also. The incision in the abdominal wall at term should be well to the outside of the rectus muscle.

Goitre. This is a complication of pregnancy which may end in disaster if care be not taken. If the case be one of simple goitre, there need be no fear, but if it is of the exophthalmic variety and is accompanied by tachycardia and

the other symptoms of this disease, it may be regarded in the same light as severe heart disease and treated as such.

In the event of operative interference being necessary, ether and not chloroform should be used as anaesthetic.

Haemorrhoids. This is a very common accompaniment of pregnancy, especially in patients who are subject to this complaint in the non-pregnant state. Constipation should be treated. If an abdominal belt has not been worn, it should be ordered. Lead lotion compresses are very useful in some cases, hot fomentations in others. An ointment consisting of bismuth subgallate, resorcin, oxide of zinc, adeps lanae and vaseline has been very successful in our hands.

Gonorrhoea in pregnancy is a dangerous complication, whether developed before or after conception, for unless the discharge is controlled, sepsis may occur in the labour. During pregnancy hot vaginal douches of cyllin ʒj to the quart at very low pressure is the best treatment: if there is any ulceration of the vaginal part of the cervix, it may be necessary to apply silver nitrate 5 per cent. to it, taking care to avoid the cervical canal. The danger of the development of ophthalmia neonatorum is sufficient to warrant treatment during pregnancy.

Pregnancy and tumours. It may be extremely difficult to diagnose these conditions. The differential diagnosis has been given on p. 65.

Pregnancy may be complicated by tumours, the most common of which are ovarian, and fibroids of the uterus. Carcinoma of the uterus may be an accompaniment also.

Ovarian cysts. Unless of very small size, these tumours when diagnosed during pregnancy should be removed.

Myomata (see Fig. 152) or fibroids often cause sterility. They are, however, a frequent accompaniment of pregnancy.

They may tend to produce abortion, and complications in labour may be expected (see p. 404). They may by the addition of their bulk cause pressure on the bladder, with retention of urine in the earlier months of pregnancy, in which case the patient must be made safe by myomectomy if possible. If not, hysterectomy may be necessary.

The cardinal symptom of myomata and pregnancy is

severe pain, and we have known this so severe that hysterectomy was necessary.

In treatment during pregnancy, the ideal to aim at is expectancy; *i.e.* if it is thought that there will be no trouble

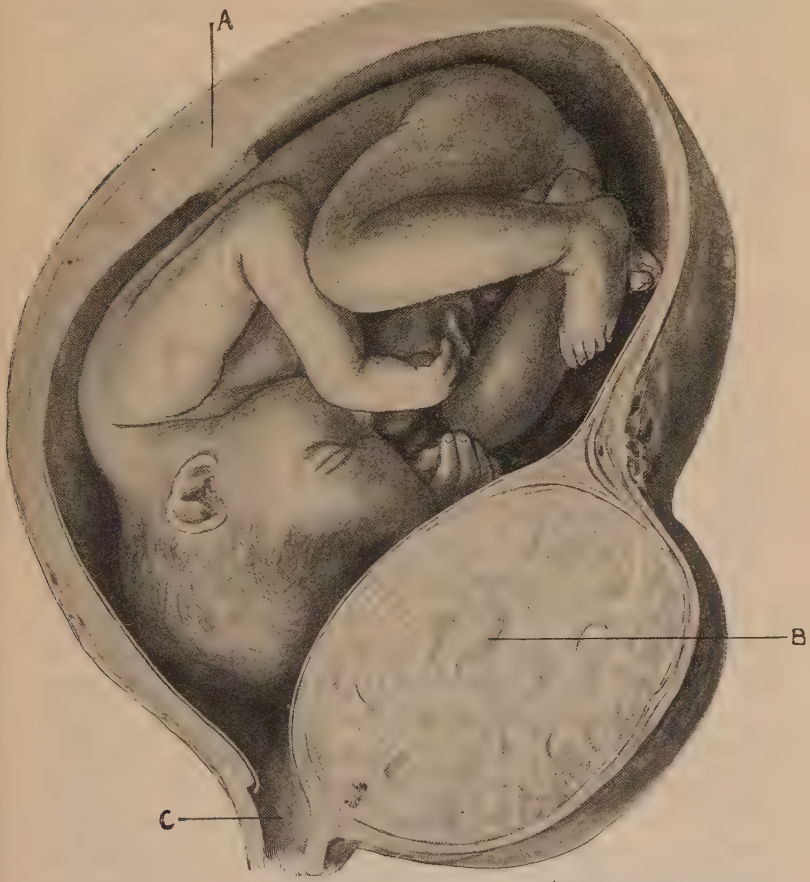


FIG. 152.—Myoma causing obstruction to labour. A, placenta; B, myoma; C, cervix. (Rotunda specimen.)

in labour, leave it alone. If not, myomectomy may be thought of, bearing in mind that abortion may follow.

Malignant disease and pregnancy. Carcinoma of the cervix is the most common variety, although this disease is rare in pregnancy. There have been a few cases in the literature of adenocarcinoma of the uterus, complicating

early pregnancy and necessitating hysterectomy, but this is only diagnosed after the operation is over.

From a practical point of view, if carcinoma of the cervix is discovered at any period of pregnancy, the uterus should be removed with the ovum.

If the baby is viable, Caesarean section should be followed by Wertheim's hysterectomy.

If cancer of the rectum is discovered during pregnancy, the growth should be removed by the perineal route after a permanent colostomy. Good results have followed this treatment, and there has been no complication at labour. If the patient refuses radical operation, Caesarean section must be done at term.

Displacement of the uterus in pregnancy.

Backward displacement of the gravid uterus. The normal position of the uterus is one of anteversion with slight anteflexion. When such a uterus becomes pregnant, it rises out of the pelvis at the end of the third lunar month and then becomes an abdominal organ. This it does readily, for the posterior surface of the pubic arch, against which the fundus rests, does not project or overhang.

But the case is different when a retroverted uterus becomes pregnant. At the end of the third, or during the first half of the fourth lunar month of pregnancy it should rise out of the pelvis and become an abdominal organ. To effect this the fundus, which has been resting against the anterior surface of the sacrum, has to pass the sacral promontory. The very name, Promontory, shows that it projects. This, then, is the difference between an anteverted and retroverted gravid uterus, that in rising up into the abdomen the former has no projection to pass, and the latter has. Occasionally the retroverted gravid uterus fails to pass the sacral promontory, and incarceration of the uterus in the pelvis occurs.

It is more than likely that a woman who suffers from retroversion of the uterus will be sterile or will abort if pregnancy occurs, for there is nearly always congestion of the endometrium accompanying this displacement. The symptoms of retroverted gravid uterus must be distinguished

from those of incarcerated uterus, which are given later. They consist simply of backache, a tendency to increased frequency of micturition and possibly slight bleeding, suggesting threatened abortion. A diagnosis having been established, the uterus should be put into proper position and a pessary inserted. If this is not done, what may be the result?

Course of retroverted gravid uterus.

1. Usually the uterus slips past the sacral promontory and follows the course of an ordinary pregnancy (spontaneous reposition).

2. Abortion may occur.

3. The posterior wall of the uterus is bound down by adhesions, which do not yield. The anterior wall is not bound down, and *anterior development* results; in other words, the foetus bulges the anterior wall up into the abdomen as growth progresses. The uterus thus assumes an hour-glass shape, one portion of the foetus being in the pelvic segment, the other being in the growing abdominal segment. This partial incarceration may go on to full term, by which time the adhesions are so softened that the contractions of the uterus are strong enough to pull up the pelvic segment, and to make its contents present at the os.

In some cases this does not occur; and then when labour at full term sets in, the cervix is found pointing forwards and upwards and lying in the anterior fornix against the pubic bone. In such a case if an attempt to push the pelvic segment and its contents up out of the pelvis fails, Caesarean section is indicated.

4. The growing uterus does not rise out of the pelvis, but becomes *incarcerated* and fills all available space in the pelvis, crushing and squeezing all the other pelvic organs. The symptoms are those of pelvic pressure.

Signs and symptoms of incarceration.

Bladder and urethra. The bladder and urethra are the organs most affected by the pressure of the gravid uterus. The normal pressure of the gravid uterus merely produces irritability of the bladder and frequency of micturition.

The pressure of the incarcerated uterus leads first to stretching and blocking of the urethra and retention of urine, followed by overflow, secondly to injury of the base of the bladder, which is squeezed against the pubic bone with resulting cystitis, and lastly to sloughing of the bladder with extravasation of urine, and death of the patient. Over-distension of the bladder by interfering with the blood supply will predispose to cystitis and necrosis.

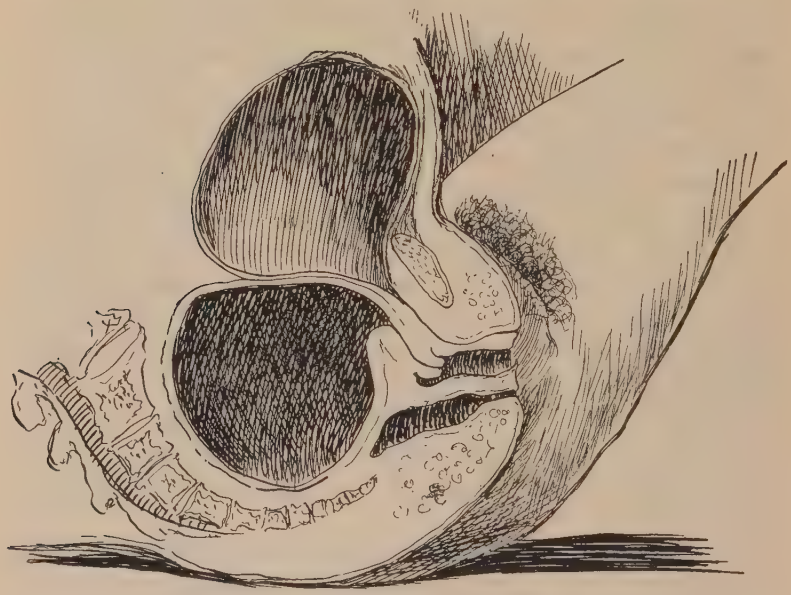


Fig. 153.—Incarceration of gravid uterus showing distension of bladder, etc.

The first symptom of which the patient complains is increased frequency of micturition. She can hold her urine only for a very short time. Soon great difficulty is experienced in passing urine; following this there is complete retention for some hours, and then constant dribbling (ischuria paradoxa) or overflow incontinence.

This first symptom may not excite suspicion that anything except normal pregnancy is present. But when the patient has missed three or four periods and urine is continually dribbling, and a short time previously she failed to urinate for a whole day, a thorough examination should be made. It is the bladder symptoms that suggest incarcera-

tion of the gravid uterus. Pressure on the rectum causes constipation, with a bearing-down sensation. Pressure on the veins causes swelling of the veins of the lower limbs, the vulva, and anus; pressure on the nerves, shooting pains down the legs. But these symptoms are all of minor importance compared with the bladder symptoms.

Examination of a patient with suspected incarcerated gravid uterus. Examine the abdomen. The bladder will be up to, or nearly up to, the umbilicus. It has again and again been mistaken for an ovarian cyst, or a pregnant uterus, a mistake which will not occur if a catheter is always passed before a vaginal examination is made. We therefore have first to consider the use of the catheter in such cases.

How to pass the catheter. The patient lies on her left side with her hips well out to the edge of the bed, or, better, in the cross-bed position. There must be a good light. The hands must be surgically clean. Clean the labia and the orifice of the vulva with great care, washing them with soap and water, and washing the soap off with warm water. Sponge the orifice of the urethra thoroughly with wool soaked in biniodide of mercury (1–1000), for any germs introduced into the damaged and distended bladder have a far greater chance of setting up acute cystitis than when introduced into the healthy bladder. It is by no means always easy to find the orifice of the urethra. The distended bladder rises in the abdomen, and pulls up the urethral orifice. Consequently the meatus lies within the vagina. Use a No. 10 gum-elastic male catheter, as the urethra is elongated.

To find the meatus. Remember that the meatus occupies the centre of a transverse wavy line that divides the smooth vestibular mucous membrane from the rugose vaginal mucous membrane. This line is the base line of the vestibule, a triangular area, the sides of which are formed by the labia minora and the apex by the clitoris. Separate the labia or introduce two fingers as a posterior speculum to expose the meatus, and pass the catheter slowly and carefully.

Sometimes urine will not flow out after the catheter has

been passed. Either (1) some necrotic mucous membrane has blocked the eye of the catheter, or (2) the catheter may have been pushed into the softened wall of the bladder itself, or (3) the female catheter may be too short to reach the bladder. Withdraw the catheter, clear it with the stylet and pass it again. A great quantity of urine will flow away and confirm the diagnosis that incontinence was due to retention.

Sometimes the catheter cannot be passed, and then the urine should be drawn off by supra-pubic puncture.

How to do a supra-pubic puncture. Shave the hair over the pubes, and carefully cleanse a small central area of skin with soap and water, ether, and biniodide of mercury. With clean hands plunge a boiled trocar and cannula, of small size, boldly into the middle line, half an inch to an inch above the pubes. If the skin and instrument are clean, there is no danger, and the operation can be repeated on several occasions, if necessary.

Retention of urine, due to the obstruction of a displaced gravid uterus, may readily become a serious condition should any sepsis be introduced. The rotten bladder wall foretells the death of the patient. Either rupture or perforation by ulceration leads to extravasation of foul urine and sepsis; or a severe cystitis is set up, which may quickly or slowly kill the patient by sepsis, or lead to ascending pyelo-nephritis or pyaemia.

Having emptied the bladder and ascertained that the abdominal tumour was a full bladder, make a bimanual examination. For this the patient must be in the cross-bed position.

What is felt by bimanual examination. Pass two fingers into the vagina and examine the vulva and vagina for the blueing of pregnancy. Then feel that the posterior fornix is obliterated by a large, elastic, globular swelling, which fills up the vagina. The cervix will be pushed up behind the symphysis. It is always difficult to feel and sometimes cannot be reached. The anterior vaginal wall, and the wall of the anterior fornix, are stretched. Bimanually no organ can be felt occupying the place of the normal anteverted uterus.

Exclude other causes of pressure on the bladder with retention and overflow of urine.

Diagnosis. The presence of a pelvic haematocele is excluded by the absence of any history of bleeding, or signs of internal haemorrhage, by finding that the wall of the anterior fornix is stretched, that the cervix looks directly forwards and upwards, not downwards, and by failing to feel the anteverted uterus bimanually.

A large fibroid in the posterior wall of the uterus is excluded by the menstrual history, by the stretching of the wall of the anterior fornix, by the fact that the cervix looks forwards and upwards, not downwards as it usually does with a large fibroid, by failing to feel the uterus bimanually, and by the difference in consistence.

The signs of pregnancy also suggest a retroverted gravid uterus. Exclude a fibroid in the posterior wall of the uterus associated with pregnancy, by the difference of the anterior fornix, the direction of the cervix, by the absence of the body of the anteverted uterus, and by the consistence of the tumour.

Replacement of the uterus (see Fig. 154).

Before incarceration. When a diagnosis is made of a backwardly displaced pregnant uterus, as yet without pressure signs, having carefully excluded haematocele, replace the uterus bimanually, or with a bullet forceps on the cervix and finger in the vagina, as described for incarcerated uterus. Keep it anteverted by a Smith-Hodge pessary until the fifth lunar month. Do this, too, if signs of threatening abortion are present. If failure results in efforts to replace it by either of these methods, success may be attained if the patient returns at short intervals, or it may right itself. Under gas anaesthesia it will be possible to replace all cases of simple backward displacement of the gravid uterus.

After incarceration. The bladder should be empty. We usually attempt to replace the uterus when the woman is in the cross-bed position. The knee-chest position is used by some obstetricians, but we do not recommend it. It is uncomfortable for the patient and it is difficult to

anaesthetise her in this position. We, therefore, try first bimanually, then with a bullet forceps and two fingers in the vagina, giving an anaesthetic if necessary.

Fig. 154.—Replacing a retroverted gravid uterus. (This is an alternative method to two fingers in the vagina).

The vagina is douched. Put a sterile bullet forceps on to the posterior lip of the cervix. It is not always easy to do this. If it cannot be reached, catch the uterus as near the posterior lip as possible. Then place two fingers in the vagina. With these push the body of the uterus

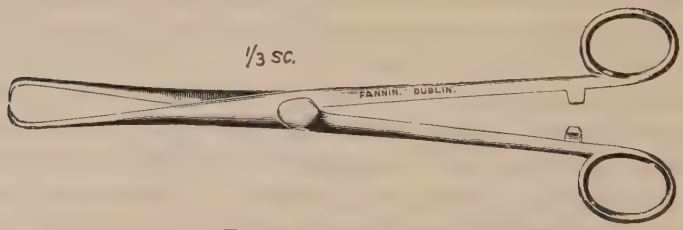


Fig. 155.—Bullet forceps.

upwards and to one side of the sacral promontory, and at the same time pull the bullet forceps downwards. If this fails after steady pressure, or if the patient's abdominal muscles are tense, give her an anaesthetic until there is complete relaxation. Then put two fingers into the vagina and try again, steadily maintaining pressure for some minutes.

Failing replacement, we think it is better to wait for

twelve to twenty-four hours, emptying the bladder meanwhile every eight hours by a catheter. Then repeat the attempt, which will often meet with success. If successful, keep the uterus in position for two months with a Smith-Hodge pessary. Replacement in these cases is not the simple matter it is in an unimpregnated uterus. The cervix can be pulled down without any movement resulting in the fundus, and the softened fundal wall can be indented with the finger in the rectum without any general movement of the uterus.

In former days it was necessary to advise the induction of abortion by different methods, and some still recommend it by pulling the cervix down and rupturing the membranes: others still suggest introducing an aspirating needle through the posterior uterine wall and rupturing the membranes. When it has been found impossible to replace the uterus bimanually, the best procedure to adopt is to open the abdomen, try to replace the uterus by traction from above combined with pressure from below, after which a pessary is inserted. Any form of suspension, either of the uterus or of the round ligaments, is not advisable in these cases. If this fails, do anterior hysterotomy, *i.e.* open the anterior uterine wall, and remove the ovum. If, however, it is possible to expose the os uteri, tents may be inserted or the uterus may be emptied immediately.

Cystitis. The incarceration has been overcome, but the inflammation of the bladder due to it remains. The cystitis may be very severe after the uterus has been put into position. Induction of abortion may be necessary to save the patient's life; or acute cystitis followed by chronic inflammation makes her an invalid.

Cause of cystitis. Whenever tissue gets damaged in the body, bacteria are very liable to attack it. The bladder is damaged by over-distension from the retained urine which interferes with the circulation, and by direct pressure from the incarcerated uterus. The only path of invasion, which can in some degree be controlled, is that opened by passing a catheter, and that is why careful cleansing of the urethral orifice and the use of a sterile catheter passed by sterile hands are imperative. If the pressure has been pro

longed, direct sloughing of the base of the bladder occurs, or perforation by ulceration. More commonly the patient is seen before such grave results have ensued, but the damaged bladder, invaded by bacteria, has to pass through an attack of acute inflammation.

Signs and symptoms. The patient suffers severe urethral pain when urinating, and, owing to irritability of the bladder, she has to pass urine frequently. There is tenderness over the bladder, if pressed on from the vagina or abdomen. The temperature and pulse vary according to the degree of inflammation. In severe cases the temperature may reach 104° F., and the pulse be over 120. The patient is then exceedingly ill, both owing to the septic intoxication which threatens her life, and to the exhaustion due to the pain and loss of sleep from frequent micturition.

The urine is ammoniacal and turbid. It contains blood, pus, and epithelial débris. In severe cases the mucous membrane sloughs and comes away through the urethra. It has a dirty wash-leather appearance.

Treatment. Washing out the bladder. For this purpose use the ordinary douche can and a small Bozeman's catheter. Put the patient in the cross-bed position, and cleanse the orifice of the urethra. Raise the end of the Bozeman whilst the fluid flows, to empty it of air. Pass it into the bladder. Cover the exit hole of the Bozeman with the thumb and fill the bladder, until the patient feels she must pass water. Then let the fluid run out. Again fill the bladder and let the fluid run out. Repeat until the return fluid is clear. Wash out the bladder two or three times a day with warm boric lotion. An anaesthetic is not needed. Once or twice a week inject three grains of nitrate of silver in three ounces of water, after the bladder has been washed out with boric lotion. We have found this treatment satisfactory in mild cystitis.

Drugs. Morphine or opium is needed for the severe pain of cystitis. Belladonna, hyoscyamus, benzoate of soda, cubebs, buchu are used as in other cases of cystitis. Urotropin (grs. 10), three times a day in a tumbler of hot water, is recommended, and we think is useful.

If cystitis does not yield readily to this treatment, the

use of vaccines is indicated, particularly if the infection is due to the colon bacillus.

PROLAPSE OF THE UTERUS IN PREGNANCY

Prolapse of the cervix and uterus constitutes a serious complication of pregnancy and labour.

During pregnancy the softened and congested tissues are very liable to injuries which may result in ulceration. During labour this ulceration may give rise to sepsis.

In many cases when the os opens, the cervix is pulled up and retracted over the head, occasionally incarceration of the cervix occurs, leading to sloughing, and sometimes to rupture of the uterus.

If prolapse is present during labour, the normal mechanism may be interfered with : on the contrary, however, labour will progress in most instances without complication.

If the cervix is prolapsed outside the vulva, it should be kept clean with antiseptic compresses.

In the third stage it may be necessary to draw up the uterine wall into the abdomen to express the placenta. Manual removal is occasionally called for.

Rectocele and Cystocele. Prolapse of the vaginal walls, rectocele and cystocele, may cause constant discomfort during pregnancy, from moisture, pruritus, and frequent micturition. The best treatment is to insert a ring pessary, which should be changed every month during pregnancy.

ANTEFLEXED UTERUS OR PENDULOUS ABDOMEN

During the latter weeks of pregnancy the uterus falls downwards and forwards, and the abdomen becomes more pendulous. This characteristic is exaggerated in contracted pelvis, and in relaxation of the abdominal muscles, which occurs frequently in multigravidae. Twins and hydramnios also cause the abdomen to become more prominent. A pregnancy belt as illustrated on p. 44, worn during pregnancy, will hold up the uterus and make the patient more comfortable.

PREGNANCY IN THE MALDEVELOPED UTERUS

Uterus unicornis. In this pregnancy is uneventful.

Uterus bicornis. When pregnancy occurs in either

horn in any variety of uterus bicornis the diagnosis must be made from tubal pregnancy. This is easy to do after careful bimanual examination. Often in these cases a decidua is found in the non-pregnant horn. Labour is, as a rule, uneventful.

PART IV

ABNORMAL LABOUR

CHAPTER XVI

LABOUR: ITS ABNORMALITIES

Occipito-posterior Presentations—Brow, Face, Anterior Fontanelle, Posterior Fontanelle, Breech—Transverse—Compound Presentations—Labour with Malformed Children.

THE management of abnormal labour is very nearly synonymous with delays in labour.

Delays have for convenience been described in the past as being due to three main causes—the Powers, the Passage, and the Passenger. The four main sections with which this chapter will deal embody these three types of delay, and are :—

(1) Abnormalities connected with the child or the presentation of the child.

(2) Abnormalities connected with the uterus.

(3) Abnormalities connected with the pelvis.

OCCIPITO-POSTERIOR PRESENTATIONS

Frequency. Of the 13,511 deliveries, excluding abortion, between 1903 and 1910, there were 130 cases of persistent occipito-posterior, or 1 in 104.

This is a smaller proportion than in other clinics, and the only explanation we can give is that time is allowed for rotation to occur, and we do not apply forceps early. Thirty-one of these cases were delivered with forceps.

Cause. The main causes are

(1) Feeble uterine pains.

(2) Damaged pelvic floor and levator ani muscles which retard internal rotation.

These factors encourage—

(3) Bad flexion, and this produces a state of affairs in which the sinciput is lowest and rotates to the front.

(4) A very small head may remain as a P.O.P., but has no clinical significance; and the converse is true relative to a very big pelvis.

In addition a partially extended, instead of a flexed, position of the foetal spine favours bad flexion of the head.

Course. In most cases of Vertex III or IV good contractions of the uterus push the child's head down, and with descent there is flexion. The occiput becomes the most advanced part of the foetus, and gets pushed by the muscles of the pelvic floor to the front. The delivery is then the same as in Vertices II and I.

If the pains are feeble, only partial flexion results. The front part of the head is then relatively as low or lower than the occiput, and is pushed to the front, or a damaged levator ani and the feeble pains fail to cause anterior rotation. We then get a permanent occipito-posterior presentation, and the head maintains its position when on the perineum or pelvic floor. Two things may happen:

(1) The patient may be sent to sleep, good pains come on when she wakes, and the child is born either with or without rotation of the occiput to the front; (2) artificial aid is needed to effect delivery.

Diagnosis. By abdominal palpation (see Fig. 156) it is not difficult, as a rule, to diagnose occipito-posterior positions. The whole uterus appears larger than normal because of the partially extended spine. The breech is felt at the fundus, but, on tracing it downwards, instead of feeling the back, the fingers dip into a hollow, between the breech at the fundus and the head at the brim, and in this hollow the knobs of the limbs are felt. Limbs are always readily felt in these cases. The partial outline of the back can be felt along one flank, and the back is noticeably extended: this is probably caused by the convexity of the back encountering the lumbar vertebrae: this extension of the back helps in the slight extension of the head. The groove formed by the anterior shoulder may be mistaken for the retraction level. By Pawlik's grip the head

is found fixed in the brim. Owing to the partial flexion the forehead is easily felt in front. The characteristics, then, of an occipito-posterior presentation are the breech in the

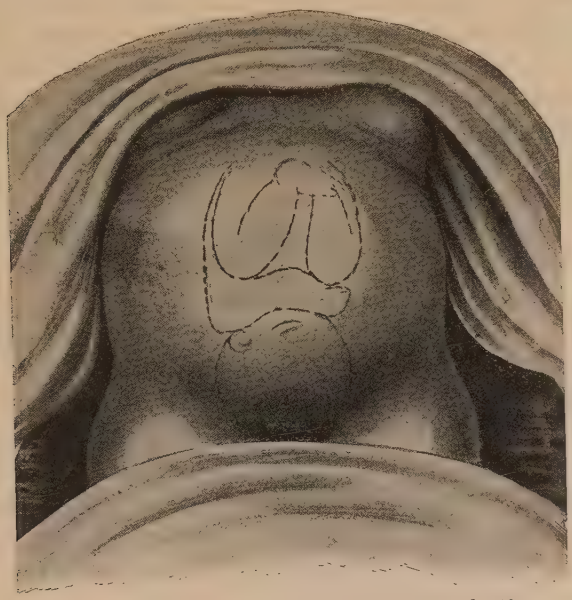


Fig. 156.—Vertex III as felt by abdominal palpation.

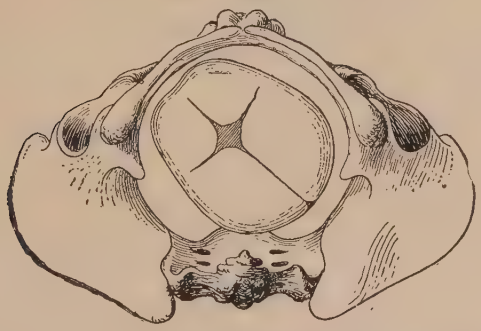


Fig. 157.—Vertex IV as felt by vaginal examination.

fundus, the head fixed in the pelvic brim with the occiput posterior, and a hollow between the two in which the outline of the limbs can be felt. The foetal heart is heard far out in the flank, but not as distinctly as in Vertices I and II. If the head has descended deep into the pelvis, the fourth grip is used to detect it.

By **rectal examination** it may be possible to determine the posterior position of the occiput.

Vaginal examination (see Fig. 157). We do not, as a rule, make a vaginal examination in these cases. If it is desired to confirm, by vaginal examination, the diagnosis made by palpation, pass one or two fingers into the vagina and feel the vertex. Then feel for the sagittal suture running in the line of one or other oblique diameter. Passing the fingers along this suture, feel the fontanelle near the sacrum. At the other end of the sagittal suture, near the pubes, is the anterior fontanelle. The anterior and posterior fontanelles can sometimes be felt in these cases, when the head is fixed and the os sufficiently open. If the posterior fontanelle is behind and to the right, the diagnosis is Vertex III; if behind and to the left, Vertex IV.

There is another feature discovered by vaginal examination that will sometimes first cause a suspicion of occipito-posterior, namely, that the presenting head seems crowded to the front against the pubic arch, and there is plenty of space between the head and the sacrum. When in doubt about the diagnosis, give an anaesthetic, when the ear or even the shoulder may be felt.

Another late diagnostic point lies in the fact that when forceps are applied, the large occipito-frontal diameter which must come over the perineum bulges and tears it before it has descended to its full extent.

Treatment. In considering this, one must decide on the possible outcomes when the occiput is posterior.

(1) It may rotate if pains are good.
(2) It may be born as a persistent occipito-posterior.
(3) Manual rotation may be followed by natural delivery.
(4) Manual rotation may be followed by forceps delivery.
(5) The forceps may be used as a rotator, and the child be born as an occipito-anterior.
(6) The forceps may deliver the child as a persistent occipito-posterior.

The first important point in the treatment is to treat the inertia which may be present: in other words, to diagnose whether the cause is from inertia or from a deficient pelvic

floor, when the obvious step to take is to treat the cause. That is, the uterine inertia is the primary factor, the malpresentation is secondary. The inertia is usually late in labour, and must be treated on the lines laid down on p. 405.

This is the type of case where natural delivery occurs with or without rotation.

The next decision to make is as to whether any rotation at all should be done. Our experience is that the chance

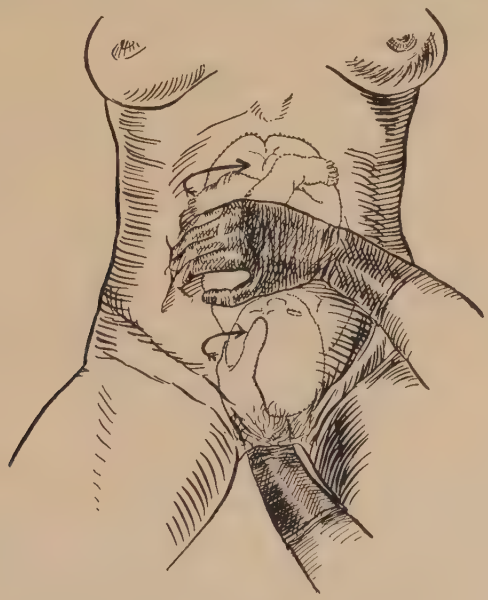


Fig. 158.—Occipito-posterior: bi-manual rotation. (Seldom done at the Rotunda.)

to rotate seldom arises, for many of these cases are born unrecognised, and this is accounted for by the fact that the large caput succedaneum which is present prevents an easy diagnosis. When, however, the condition is recognised, what should be done?

(*a*) Leave the patient alone, treat the inertia (see p. 407), and in at least 90 per cent. of cases natural delivery will occur either as an occipito-anterior or occipito-posterior presentation. If delay arises before conditions are present for forceps delivery, rotation may be encouraged by folding a towel into a hard roll, and pressing it into the side of the abdomen, parallel and as close to the back

of the child as possible; a binder keeps it in position; it has for its object the movement of the back in the direction of pressure, *i.e.* towards the front of the mother.

Manual rotation. The best way to do this is to pass the whole hand into the vagina, using the hand corresponding to the back, *i.e.* the left hand when the back is to the right, at the same time drawing the shoulder forwards with the hand on the abdomen (see Fig. 158). Another method is to use the hand corresponding to the forehead, to grasp it, at the same time pressing upwards. This is with the object of producing flexion, thus bringing the occiput lowest, so that it will then rotate to the front. It is said to be possible sometimes to pass the hand high in the vagina up to the shoulder and rotate it in this way. We do not recommend this method. In fact the opportunity for performing these manipulations seldom arises and when they are attempted rotation is not always successful.

Forceps. When all conditions for forceps application are present it may be necessary to apply them after rotation has occurred. Or rotation may not occur, in which eventuality the head is delivered by forceps as a persistent occipito-posterior.

Forceps may be applied after manual rotation, or the forceps may be used as a rotator. The latter is not advisable, as extensive tears of the vagina may result. Sometimes, however, when forceps are applied with the "face to pubes," rotation occurs quite easily: the instrument should then be removed and reapplied, after which the head is delivered with the occiput in the anterior position.

To sum up the possible results in occipito-posterior presentation.

1. Nature may bring the occiput forward, followed by spontaneous delivery.
2. Spontaneous delivery as a persistent occipito-posterior.
3. Forceps delivery after spontaneous rotation.
4. Forceps delivery as a persistent occipito-posterior.

These are the most likely outcomes.

After manual rotation spontaneous delivery is rare, as the delivery is usually completed with forceps.

Moulding in occipito-posterior presentation. The occipito-frontal plane is lessened. The frontal bones are displaced beneath the parietals.

The caput succedaneum. This is found in the middle or front of the left parietal in Vertex III, in the middle and front of the right parietal in Vertex IV.

Mechanism. The occiput is usually primarily posterior, and one of two things must happen. Either the occiput rotates through an eighth of a circle and is born as a per-

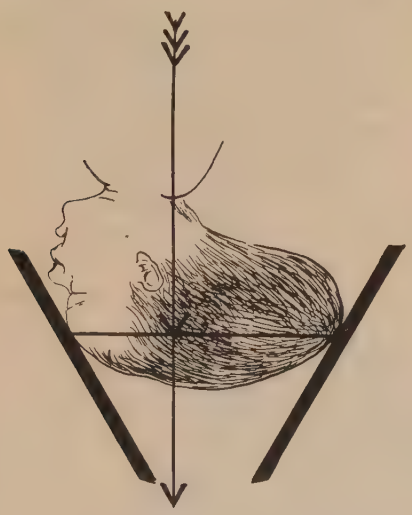


Fig. 159.—Dolichocephalic skull. A cause of extension.

sistent occipito-posterior, or else it rotates through three-eighths of a circle and is born as an occipito-anterior presentation : the latter is the more usual.

When posterior rotation occurs, the forehead becomes fixed under the pubes and the occiput is born by a movement of flexion followed by a slight amount of extension for the remainder of the birth.

A more favourable mechanism, and one which allows the sub-occipito-frontal diameter to appear instead of the occipito-frontal, is where a point much higher up close to the anterior fontanelle becomes the fixed point.

The movements of the head are : (1) fixing of the forehead under the pubes; (2) partial flexion; (3) slight

extension causing birth of the face; (4) birth of the body as in occipito-anterior presentations.

BROW

Frequency. In 13,511 hospital deliveries over a period of seven years, there were 18 cases of brow or 1 in 750. This number is probably less than the occurrence in reality, for many Brows must undergo spontaneous change to vertex or face presentations.

Varieties. See p. 115.

Nature. In occipito-posterior presentations flexion is not complete. In brow presentations the foetal head is neither flexed nor extended, it is in a condition of balance between the two. It commonly becomes a face presentation, but it sometimes persists as a brow presentation. It is the rarest and most unfavourable of all head presentations, for the supra-occipito-mental diameter, 13 cm., the largest of all foetal head diameters, has to pass. Hence, except where the pelvis is very roomy, or the foetus very small, interference is necessary in cases of brow presentation.

Causes. Brow may be regarded as half-way to a face presentation, and not infrequently becomes a face, therefore the causes of brow are similar to those of face. They are, in short, anything which hinders complete flexion of the head, and thus prevents the lever and slope from producing flexion. They are—

1. The cord round the neck will sometimes favour extension.

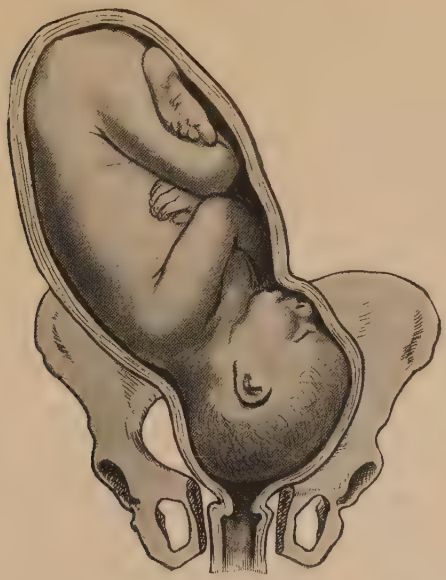
2. A tumour of the neck acts similarly.

3. A dolichocephalic skull (see Fig. 159), which is longer behind than in front, reverses the normal lever action, which produces flexion.

None of these is a common cause, and none of them has any practical importance, for they cannot be diagnosed in time to prevent a brow or face presentation occurring.

More frequent, and practically important causes are—

4. Obliquity of the uterus, either lateral or forward, evidenced in the latter case by a pendulous abdomen. Owing to the slope of the uterus, either the back of the head, or the face of the child, lies over the pelvic brim,



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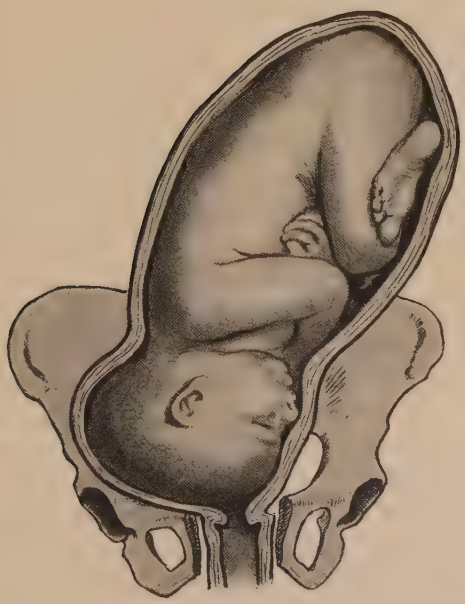

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Fig. 160.—Effect of obliquity of the uterus in producing extension.

according as the foetus looks away from the deflected uterus or towards it. If the face lies over the pelvic inlet, the contracting uterus tends to push it down into the brim. A lesser degree of this will produce a brow (Fig. 160).

Brow presentation is rarely primary and is unstable—face or vertex are the usual developments: conversely brow may develop in the course of labour from either presentation—especially in flattened pelvis.

5. Flattened pelvis. In flattened pelvis, the transverse diameter of the brim is the longest. Consequently the sagittal suture, which corresponds to the longest diameter of the foetal head, also lies transversely. The head has to squeeze through this flattened pelvic inlet. The back of the head is wider than the front (bi-parietal diameter, 9·5 centimetres; bi-temporal, 8 centimetres), and hence the front advances more readily than the back, and a face or a brow presentation results.

Diagnosis. Brow presentation should be recognised by abdominal palpation, but the diagnosis should always be confirmed by the vaginal examination.

Abdominal palpation. Notice first the appearance of the uterus. It may look larger than normal, and bulged to one side. This is only suggestive, not diagnostic. The breech at the fundus, and the position and direction of the back and limbs, are felt by the umbilical and fundal grips.

Pawlik's grip is the one that gives most information. The head does not fit into the brim, so there will be found a large head, which can be moved from side to side, when the uterus is not contracting. This alone will indicate something wrong, for if the woman is in labour, the head normally should be held by the lower uterine segment, and it should not be possible to make it ballotte between the pains. The head is above the brim. The absence of flexion or extension causes it to be felt equally well, and on the same level, on both sides. The sharp chin and the great width between the fingers and thumb when grasping the upper limit of the head, before they sink into the groove of the neck, suggest the probability of a brow presentation. But in all abdominal palpations the ease with which the foetal parts are felt depends largely on practice, on the state of

the patient's abdominal wall, and her nervousness. If, as in rare cases of big pelvis, the head is fixed and descended, even though the brow presents, there is no cause for anxiety.

Vaginal examination. Make a vaginal examination with one or two fingers first during a pain. The head is not held by the lower uterine segment, and therefore the fore-waters and after-waters communicate. The consequence is, that the extra weight of the waters compressed by a uterine contraction makes the membranes bulge down through the os like a sausage. Be careful not to press on them, for the unsupported membranes are liable to rupture early and easily. *This sausage-shaped bag of membranes is another sign that something is preventing the presenting part from fixing or being grasped by the lower uterine segment.* When the pain has passed off, feel the os, and discover how much the cervical canal has opened and been taken up. The third sign that the head is not held by the lower uterine segment is the extreme difficulty or impossibility of reaching the presenting part; also that the cervical canal, though to some extent dilated and dilatable, is empty and hangs down like a curtain from the vault of the vagina. These three signs go together, and show that the presenting part is not grasped by the lower uterine segment: (1) ballotting of presenting part, (2) sausage-shaped bag of membranes, (3) difficulty in reaching presenting part by the vagina.

If the presenting part cannot be reached properly. We advise passing a whole or half hand into the vagina. The head can then be reached. Examine it only between the pains. The points upon which to make the diagnosis of brow are: (1) Locate the anterior fontanelle. (2) Feel the brow, the bony ridges of the eyebrows, and the bridge of the nose. Obtain some information as to the size of the pelvis, if the patient is a primigravida. (See Contracted Pelvis.)

Cases in which the brow has descended into the brim. The brow may then be somewhat masked by a large caput, and very probably the membranes will be ruptured. The foetal head can then be reached easily. By careful and precise examination locate the anterior fontanelle, the brow, the orbicular ridges, the bridge of the nose, and press gently over the eyes. During a pain keep a

finger pressed against a bony part of the head, and notice whether it advances at all with the pain. When the pain has passed, try to push the head up to see whether it is tightly and immovably jammed.

Treatment. In considering the treatment of brow presentation, the cause must first be determined. If there is contraction of the pelvis, the appropriate treatment, *e.g.*

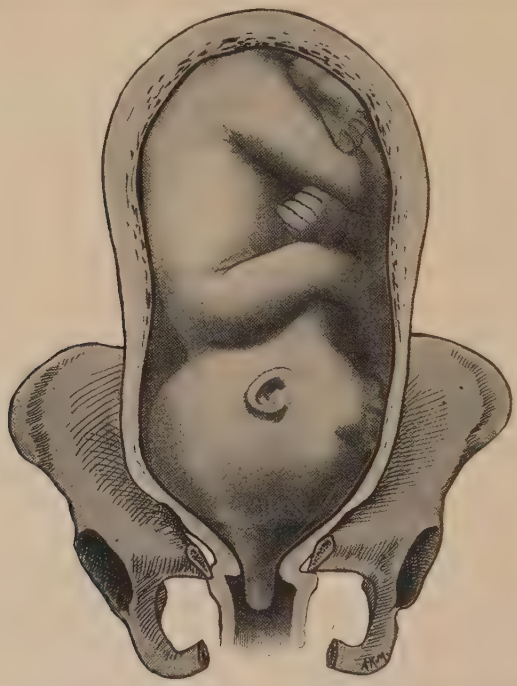


FIG. 161.—Diagram to show bulging membranes due to non-fixation of the head.

Caesarean section, must be done. If, however, there is no apparent contraction or disproportion, the treatment is as follows.

To convert a brow to a vertex presentation by external manipulation. Stand by or sit at the edge of the patient's bed, as if about to undertake the fourth, or pelvic abdominal grip. Raise the shoulders of the child as high as possible towards the fundus. Place the fingers of one hand on the chest of the foetus, and the fingers of the other hand over the occiput. Push the chest in the direction of

the child's back and the occiput in the opposite direction, increasing the flexion of the back and head. If successful push the head into the pelvic brim, and keep it in this position while the nurse puts on a tight binder, pinning it from above down. Then make a vaginal examination to see that the vertex is presenting. We have found this treatment successful, and no harm need result from trying it.

Brow is diagnosed with the half or whole hand in the vagina, the membranes are unruptured. Try to change the brow into a vertex *if the head is not fixed.* To do so, put the patient in the cross-bed position, and, between the pains, with the fingers in the vagina, press the fore-

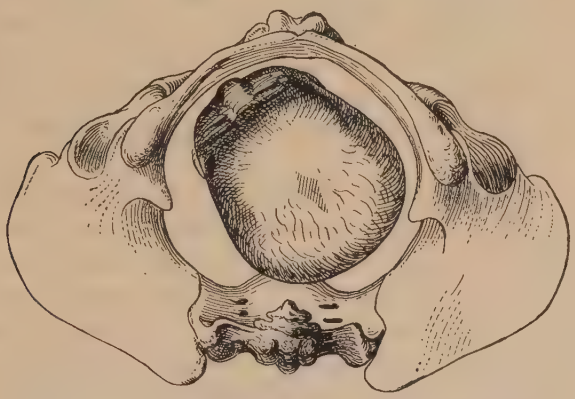


Fig. 162.—Brow IV as felt by vaginal examination.

head upwards, and with the other hand on the abdomen, press the occiput down. If successful, keep the head in position whilst the nurse puts on a binder, and make sure by a vaginal examination that the vertex presentation is maintained. *If the head is fixed,* get the patient into the cross-bed position, and try to push up the vertex, and bring down the chin, for a face presentation is safer than a brow.

If contraindications to version are not present, and it appears as if the after-coming head will come through, podalic version may be done: if contraindications are present, the brow may be changed to a vertex, and forceps applied tentatively: if this fails, pubiotomy is performed. The latter operation has been very successful in some cases of this type. If it is believed that tentative forceps may

fail, and other indications are present (see p. 602), the lower segment Caesarean operation may be done at once.

If the brow cannot be changed, and the membranes are unruptured, wait, keeping the patient in bed, until the membranes are ruptured.

When the membranes rupture, and the head is not fixed. Two fingers can always be passed through the os, and there is not the same fear of tearing the sodden os as in placenta praevia. Turn the child by bipolar version between the pains.

If the head is fixed and either mother or child shows signs of distress. If the os is sufficiently open to put on forceps, do so after making the presentation vertex. If not, a decision must be arrived at as to whether the tear which is certain to occur when forceps are applied before the os is fully open is justifiable: if not, and the child is alive, the lower segment Caesarean section is the operation of choice.

Of course if the child be dead, craniotomy must be done.

Mechanism of brow presentation. That a brow will be born unchanged is unlikely unless the head is extremely small or the pelvis very large. When spontaneous birth occurs, the movements are descent followed by anterior rotation of the brow; the brow becomes fixed under the pubes and a movement of slight extension occurs: this brings the upper jaw under the pubes, and a movement of flexion delivers the brow to the occiput. A movement of extension next causes delivery of the face and chin.

The remainder of the birth is as already described. Although the birth of a full-term child is unusual as a brow, yet we have had in our practice a case where the weight of the child was 6 lbs. and the circumference of the head 35 centimetres.

The diameters of the brow which pass through are the supra-occipito-mental 13 centimetres, and biparietal 9·5 centimetres.

Moulding (see Fig. 163). There is diminution of the supra-occipito-mental, and increase in the occipito-frontal diameters, there is marked prominence of the forehead, with flattening of the vertex.

The caput succedaneum is placed on the forehead between the orbital ridges and the bregma.

FACE

When the head, instead of flexing, extends, face presentation results.

Frequency. In the seven years, 1903–10, in 13,511 deliveries there were 23 cases, or 1 in 587. It may be primary or secondary. It is rarely recognised in pregnancy, and results in most instances as a direct result of labour.

Fig. 163.—Moulding of brow delivery.

Causes. The causes of extension leading to face presentation are those that have already been fully described under brow, namely: (1) the cord round the neck, (2) a tumour of the neck, (3) a dolichocephalic skull, and commonly (4) obliquity of the uterus, with either lateral or pendulous abdomen, (5) contracted pelvis, tumours, hydramnios.

Varieties. See p. 115.

Course. If the chin is to the front, or turns to the front, the child is, as a rule, born without difficulty. This occurs in the great majority of cases. But with partial extension and the chin posterior, the forehead first reaches the pelvic floor and turns to the front. The child descends, until the head, neck, and upper part of the chest are in the pelvic cavity. Further progress becomes impossible, unless strong pains succeed in increasing the extension, making the chin the most advanced part of the foetus, and so causing it to be turned to the front. If this does not happen, the natural delivery of a living child is practically impossible (see Fig. 166), although there are a few cases on record where it has occurred. Treatment should be directed towards rotation of the chin to the front. If this fails, pubiotomy or perforation is indicated, the decision depending on whether the child is alive or dead.

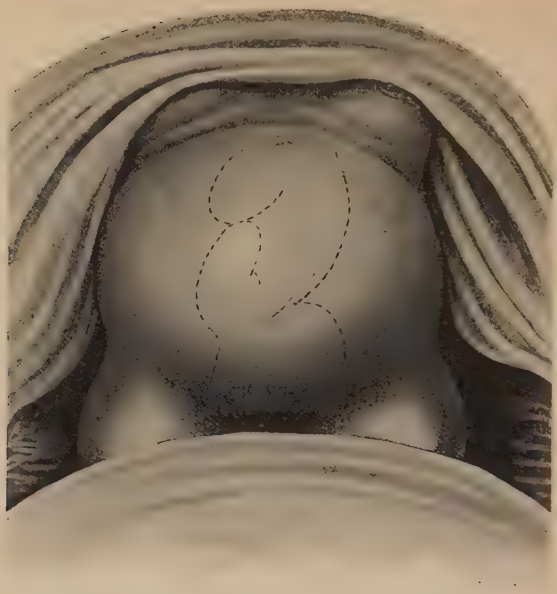


Fig. 164.—Face I as felt by abdominal palpation.

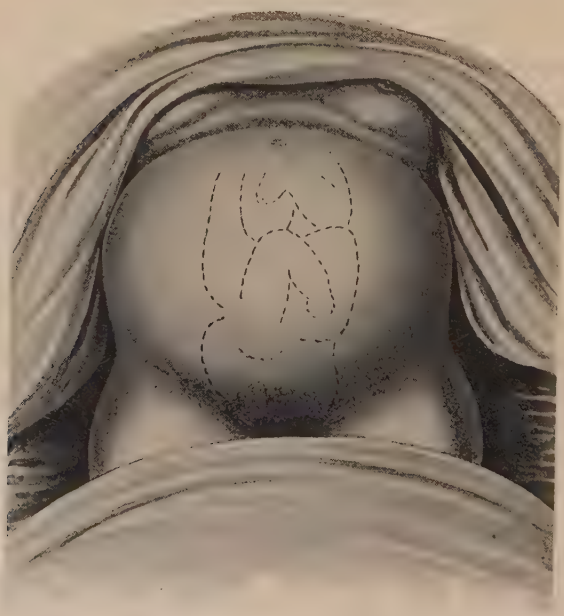


Fig. 165.—Face III as felt by abdominal palpation.

Diagnosis.—A face presentation can in most cases be recognised by abdominal palpation, and we place great reliance upon this. The rule, however, to assist diagnosis in all difficult cases by a vaginal examination should be followed.

Abdominal examination.—The appearance of the uterus suggests the presence of an abnormality.

The back of the child is deeply hollowed by extension, and this gives the clue to palpation by the first and second grips. The breech is at the fundus, and if the back is to the front the hollowed back will be felt with less ease than the partly

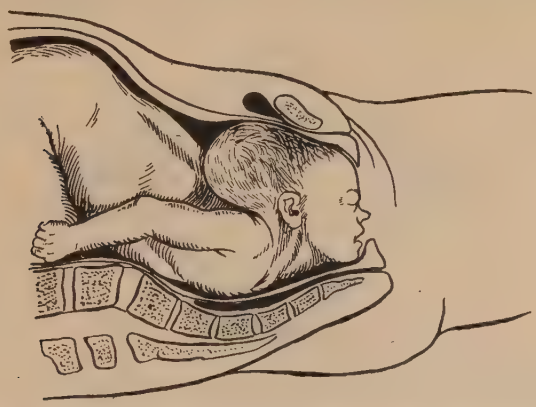


Fig. 166.—Showing impossibility in delivery of mento-posterior with the shoulders.

flexed back of a normal vertex. On the other hand, if the back is behind, the chest and limbs are pushed forward against the anterior wall of the uterus, and are felt with peculiar ease. In the first case the foetal heart is heard with difficulty, in the second easily by listening over the foetal chest.

It is Pawlik's, or the fourth grip that gives most help in diagnosis. If the head has not sunk into the pelvis, by Pawlik's grip the prominent occiput will be felt as a round, hard mass on the same side as the back, and the chin, with greater difficulty and at a lower level than the occiput, on the opposite side. This is the reverse of a normal vertex, in which by Pawlik's grip the child's forehead is the more readily felt, and is the higher part of the foetal skull and on

the opposite side to the back. The groove of the neck also runs obliquely, being higher on the side of the back than on the side of the chest, and makes a deep sulcus between the occiput and back.

If the child's head has sunk into the pelvis, use the fourth grip. The fingers are stopped by the prominent occiput on the same side as the back, but sink easily into the pelvis on the side of the child's neck and chin.

Rectal examination. The diagnostic parts of the face are readily felt by this method.

Vaginal examination (see Figs. 167 and 168). If the head is not grasped by the lower uterine segment, the

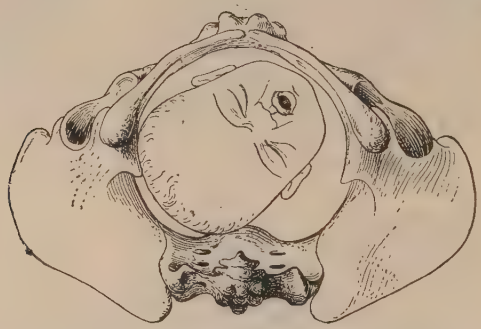


Fig. 167.—Face III as felt by vaginal examination. Left mento-anterior posterior.

cervical canal is empty and the membranes are protruding. In such a case, in order to be quite sure of the diagnosis, pass the whole or half hand into the vagina. At the same time there is evidence of contracted pelvis.

When the face has descended into the pelvis, it is obscured by a large caput and may be mistaken for a breech or for a monstrosity, especially an anencephaline foetus.

To distinguish a face, between the pains, put one finger carefully into the child's mouth and feel the ridges of the gums and the tongue. If the membranes have ruptured, feel more boldly. The ridges of the gums and the tongue are quite convincing. It is said to be necessary to distinguish an anus, and this can be done by the fact that the finger is gripped by the sphincter ani, but is not by the lips. Also meconium may stain the finger. The lips may make a slight

sucking movement, but we do not think this matters, for the chest is too tightly squeezed for the child to suck any mucus into its lungs.

Treatment. If the membranes are unruptured, and labour is progressing satisfactorily, leave the case to nature: if, however, delay is occurring, Schatz's manipulation should be attempted. We have ourselves several times turned a face into a vertex presentation by Schatz's method. As the conditions causing the presentation remain, the face presentation is apt to recur, and for a like reason, if the face is changed to a brow, the brow will not remain, but change into a vertex or back again to a face.

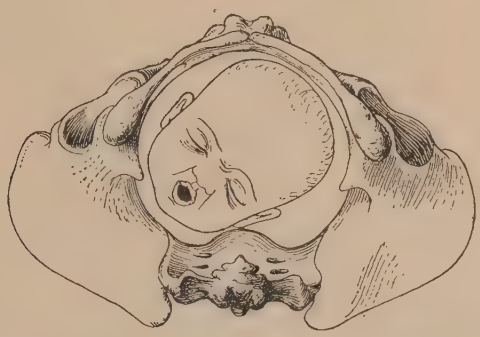


Fig. 168.—Face I as felt by vaginal examination. Right mento-posterior position.

Schatz's method (see Fig. 169). Get in position at the side of the bed as for the fourth grip of abdominal palpation. Lift the head out of the brim, with the fingers dipped down on each side between the head and the pelvis. Press the prominent chest of the child upwards, and towards the back, so that, by pressing the chest in, the back is pressed out, and so is flexed. With the fingers of the other hand press the occiput downwards and towards the middle line. When the chest has been pushed well in, press on the breech with one hand, keeping pressure on the chest with the other. If successful in partly flexing the spinal column, pressure on the breech will increase this flexion, and this will also make the head flex. If the back is not flexed, pressure on the breech will make the chest bulge forward again. The most important indication for this method is with the back anterior,

i.e. when the chin is behind. If the back is behind, the position is favourable for delivery as a face.

If Schatz's method succeeds, push the well-flexed head into the brim, and put on a tight binder to keep the child in this position.

If Schatz's method fails, others can be tried. Podalic

Fig. 169.—Schatz's method of converting a face into a vertex.

version is indicated in some cases when the os is fully or nearly fully dilated.

Baudelocque and Playfair Partridge have both suggested manipulative methods which are practicable after the membranes are ruptured. Baudelocque advised the following:—(1) To pass the whole hand into the vagina, grasp the occiput, and flex the head. The hand corresponding to the occiput

is used, *i.e.* when the occiput is to the right, the left hand is used, and vice versa. (2) To press up the chin, jaws and forehead in order to cause flexion, using the hand corresponding to the chin, *i.e.* with the chin to the right, use the left hand. The best method is that described by Thom, which consists of a combination of either of these manipulations with that of Schatz. The operator pushes up the chin, etc. with the hand in the vagina, while the hand on the chest pushes it inwards. An assistant presses down the breech.

If unable to change the presentation, let the case alone. Unless the pelvis is too small for the face to descend, *it will descend and dilate the os*, after the membranes have ruptured. If the face fails to descend and the head can be ballotted above the brim after rupture of the membranes, the case is, from a practical point, not one of face presentation, but rather a case of contracted pelvis. If the patient is seen in time, a diagnosis of contracted pelvis will have been made, and appropriate treatment carried out.

The face descends into the pelvis, the os is open, and the membranes have ruptured. Leave the case alone. If the chin is to the front, the child will be born naturally; if behind, it will in most cases rotate to the front. Should the chin be in front, do not apply forceps until there is an indication from the condition of the mother or child. Forceps is not an ideal instrument for delivery in these cases, for it does not easily adapt itself to the face; the application is more difficult; it is more apt to slip, and it is said to cause deep inspiratory movements. In spite of these disadvantages we have used it successfully in several such cases.

The chin is behind and does not rotate to the front. The treatment depends on whether there are symptoms of distress shown by either the mother or the child.

Signs of distress absent. If the reason for non-rotation of the chin is partial extension with uterine inertia, we treat the patient for inertia and as a rule prescribe morphine gr. $\frac{1}{4}$, or chloral hydrate grs. xx. In addition it is useful to keep her on the side to which the chin is pointing, as this will favour forward rotation. After a refreshing sleep stronger contractions commence and increase the extension of the

head; the chin becomes the most advanced part of the foetus, and turns to the front.

As long as constitutional symptoms of distress do not arise, we continue to wait. We have waited as long as eight hours, and then have found a single pain bring about the desired rotation, with delivery of the child, when the head was even on the perineum. Matters will be hastened, however, if it is possible to turn the child's chin forward. Put the patient in the cross-bed position, and the whole hand in the vagina, and put the fingers along the most posterior side of the child's chin. Push the chin to the front by the shortest route, either at the beginning of a pain or between

Fig. 170.—Moulding and caput of face delivery.

the pains. At the same time get the nurse to aid the rotation by external manipulation.

When signs of distress arise. If the mother's pulse-rate and temperature are rising, and the contractions of the uterus are tending to become tonic, what is to be done? The foetus is probably dead. Listen carefully for the foetal heart. If it has been heard before and cannot be heard now, or if rupture of the uterus is threatening, and the child is dead, perforate the child's head through the forehead and deliver. If the child is alive, an operation for enlarging the pelvis is indicated: perforation then is unjustifiable.

As an alternative to the above treatment, prophylactic turning at an early stage of labour has been advised. We do not turn the face in early labour: it is better practice to allow nature to proceed and to deal with complications if they arise.

Caput and moulding (see Fig. 170). The infant looks like a prize-fighter and presents a very hideous appearance, The lips, eyes and cheeks are swollen and blue from pressure, and the head and forehead are flattened. This passes off in a few days. The shape of the skull alters more slowly.

MECHANISM

In a normal face presentation the movements of the head which occur are—

(1) Descent;
(2) Extension;
(3) Internal rotation of the child;
(4) Flexion;
(5) Restitution;
(6) External rotation.

The diameters which engage are the cervico-bregmatic, 9·5 centimetres, and the bi-parietal, 9·5 centimetres.

The movements occur for the same reason as those in vertex presentation, the great difference being that extension is substituted for flexion, the cause having been given already: the main point being that the occiput in this case is the long end of the lever. After the chin has rotated to the front, it gets fixed under the pubes and the birth is accomplished by a movement of flexion. The remainder of the mechanism requires no further explanation.

Sometimes, however, the chin rotates posteriorly, or else it is primarily posterior. Birth without change, then, is often impossible, unless the child is very small or the pelvis very large, for the short neck gets stuck on the long sacrum, as it is nearly impossible for the shoulders to come through at the same time—the only possible solution.

There are two very important features about face presentations which are apt to be forgotten—(*a*) that the head has to come much lower for the greatest diameter to come through; (*b*) that when the face is on the perineum, it has extended much further than the vertex before flexion occurs, in consequence of which tears may result.

ANTERIOR FONTANELLE PRESENTATION, OR SINCIPITAL PRESENTATION, AND ITS MECHANISM

When this occurs in a very large pelvis, the head comes through as in a vertex, except that the anterior fontanelle is presenting. Internal rotation occurs, but as the sinciput is the lowest point, it will rotate, and the head is born as in a persistent occipito-posterior.

When this abnormality is due to a flattened pelvis, the head engages in the transverse diameter of the pelvis: a certain amount of anterior asynclitism occurs to bring the head through the pelvis, after which the occiput rotates to the front, and the remainder of the birth is as in vertex presentations.

POSTERIOR FONTANELLE PRESENTATION AND ITS MECHANISM

This occurs in generally contracted pelvis, and the transverse diameter engaged is usually the bi-temporal. Extreme flexion occurs, and if the head can get low enough to come right through the superior strait, the occiput rotates to the front, and the child is born as in vertex presentations.

BREECH

Breech presentation may be divided into simple and complicated. By the latter we mean when the breech is *impacted* or *arrested* in the pelvis, and these complications will be dealt with later. Simple breech may be one of four varieties, and may be complicated by events during delivery, which will be explained.

(1) **Complete or Front Breech** (see Fig. 171). This is a vertex turned upside down, the foetus being in a state of flexion, with the legs flexed on the thighs and the thighs on the abdomen.

(2) **Incomplete Breech** (see Fig. 172), where the legs are extended and the thighs flexed; this is shown on the left side.

(3) **Knee presentation** (see Fig. 173), where the thighs are extended and the legs flexed.

(4) **Footling** (see Fig. 174), where the legs and thighs are extended.

The further division of Breech into first, second, third and fourth is described on p. 115.

ERRATA

Page 358, line 27. Delete words "or Front."

Page 358, line 31. Insert after "Incomplete"—"or Frank Breech."

Page 360, line 13. "of" should read "or."

Frequency. During seven years in the Rotunda there were 359 breech presentations in 13,511 deliveries, that is, 1 in 38.

Causes. Breech is not an accidental presentation, but arises from some abnormality of the uterus, pelvis, or

Fig. 171.—Complete.

Fig. 172.—Incomplete.

Fig. 173.—Knee.

Fig. 174.—Footling.

Breech presentations.

foetus which prevents the normal adaptation of the vertex to the lower uterine segment. Thus :

1. The large head of hydrocephalus sometimes cannot reach the lower uterine segment. It is therefore not fixed, and this will permit greater mobility of the foetus in the uterus.

2. Flattened pelvis will also prevent the vertex reaching the lower uterine segment.

3. Excess of liquor amnii causes the child to float and the vertex does not fix.

4. Twins alter the shape of the uterus, and may prevent fixation of the head.

5. Placenta praevia alters the capacity of the lower uterine segment, and renders breech presentations more liable to occur.

6. Premature or dead children, being small, move about easily in the uterus, and with them breech is more common than normal.

7. The large slack uterus of multiparity will favour breech presentations.

8. Twins, by changing the relation of the foetus to the uterus, and prematurity, both result in breech presentation.

9. Hydramnios, which distends the lower segment, may act in a similar way.

In many cases no cause is discoverable.

An important cause in a primigravida is contracted pelvis. If the breech presents in a primigravida, it is always suggestive of contracted pelvis.

Danger of breech presentations. The danger to the mother is not greater than that of a normal vertex. Rapid delivery of the child's head sometimes causes extensive lacerations of the perineum. The danger to the child's life is considerable, especially when the breech occurs in a primipara, or skilled assistance is not at hand. The child dies, either because the cord is pressed on and its circulation stopped by the after-coming head, or because it takes an inspiration whilst the head is still in the pelvic cavity, and sucks mucus and liquor amnii into its lungs.

Diagnosis. By going carefully through the various routine steps in diagnosis a breech can nearly always be diagnosed. Attention to the likelihood of the presentation will first be drawn by the passage of meconium by the vagina, but this is not, of course, a feature peculiar to breech presentations. The best plan for diagnosing a breech is to imagine the vertex turned upside down, when the following will be found.

Inspection. The shape of the abdomen is unchanged.

Palpation.

Fundal grip. The head is found at the fundus. It is diagnosed from the breech by the fact that the head is separated from the back by the sulcus of the neck. If the hand is passed down towards the side of the back, the groove of the neck will be discovered. In addition, limbs will not be evident high up in the fundus when the breech is presenting, in the same way as if the breech were in the fundus. The groove of the groin might be mistaken for the neck, but, again, the proximity of the limbs avoids confusion.

The head can be ballotted : it can be moved freely from side to side between the pains, and is an obvious independent mass. When the breech is in the fundus it may be moved, but the back moves with it—movement, therefore, is not so free. While ballotting the fundal part with one hand, the back is felt with the other. It will then be clear if the movement is imparted to the back or not. These are signs upon which to rely in diagnosing that the head, and not the breech, is in the fundus. The head feels very hard, but in the absence of other signs do not rely on this, for the breech may feel quite as hard as the head.

Umbilical grip. By the second grip the fingers dip into the sulcus of the neck, and may also feel the knees or legs on one side, the back on the other. The movement of foetal limbs gives the clue to the position of the child, for they are felt in the neighbourhood of the breech.

Pawlik's grip. The presenting part may not fill the brim, and it will be found continuous with the child's back, the groove of the neck being absent. The prominent diagnostic points of the head—forehead, chin, occiput—will not be determined.

Deep pelvic grip. The chief reason for making this grip in breech presentations is to avoid the error of mistaking a breech for a shoulder. Occasionally the head may have sunk low into the pelvis, but this grip will soon demonstrate its presence. Also the possibility of another baby in the pelvis must not be overlooked.

Auscultation. This method of diagnosis will be of great assistance. Once more imagine the child turned upside

down: the foetal heart will be heard higher in the abdomen than in vertex presentations. Fig. 84 shows the different situations. In first breech it is best heard on the left side, just above or to the side of the umbilicus. In second breech, on the right and above the umbilicus; in third

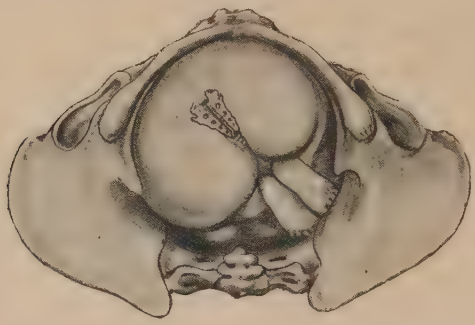


Fig. 175.—Breech II as felt by vaginal examination.

breech, on the right also, but much further over to the side, and in fourth breech in a similar situation on the left side.

Rectal examination. It is quite likely that a rectal examination will confirm the diagnosis made by palpation; if not, a vaginal examination should be made.

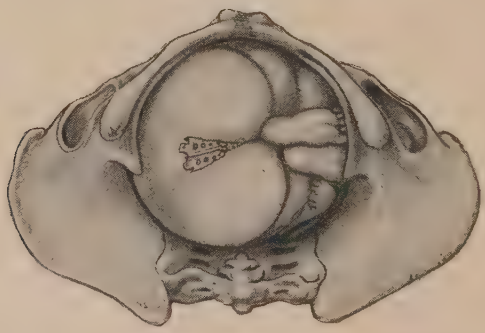


Fig. 176.—Breech III as felt by vaginal examination.

Vaginal examination (see Figs. 175, 176). When the head is at the fundus, the breech is not fixed, and a vaginal examination should be made to exclude prolapse of the cord. Also the absolute diagnosis may not have been made, and this is extremely necessary when it is borne in mind that a transverse presentation might be overlooked.

In making the examination, certain points must be looked for. Before the breech has been grasped by the lower uterine segment, two fingers will not reach the presenting part. The membranes bulge in a cone- or sausage-shaped manner through the os, because the fore waters are not shut off from the hind waters. The cervix is empty and not taken up. These conditions indicate an abnormality, but not the nature of the abnormality. If the two fingers are unable to reach, pass the whole or half hand very gently into the vagina. Between the pains feel the cervix, and do not rupture the membranes. If the os is not open, leave her alone until labour has advanced a little further. When the breech is low in the vagina, the different parts are easily felt.

They are (*a*) the tuber ischii, (*b*) the tubercles of the sacrum leading to the coccyx, (*c*) the genitalia, (*d*) the anus, (*e*) the foot or the knee.

(*a*) The tuber ischii. The hardness of these bony points may suggest the diagnosis of a head presentation, especially as the groove between the buttocks may resemble a suture, but at a suture there is overriding of bones, and a suture leads to a fontanelle.

(*b*) The tubercles of the sacrum leading to the coccyx. These are diagnostic of breech. When a large caput has formed and the membranes have ruptured, the outlines may be observed, but the tubercles will be felt on deep palpation.

(*c*) The genitalia. The male genitals are easily diagnosed and are pathognomonic of the presentation.

(*d*) The anus. The finger is grasped by the sphincter, and meconium appears upon it. The sphincter makes the diagnosis of breech from mouth.

(*e*) The foot or the knee. Occasionally a foot presents, and this has to be distinguished from a hand. With two fingers this may be very difficult. The tips of the fingers lightly touch or brush over the foot, and the sensations conveyed by them are not sufficient to give a clear image to the mind. Do not be content to remain in doubt. Pass the half hand into the vagina, and the doubt whether foot or hand presents will be removed. The even level of the five toes differs from the four fingers and outlying thumb.

The thumb also has more movement than the great toe, but the greater movement of an infant's great toe, as compared with an adult's, makes this sign a little misleading. The heel, however, is quite distinctive, and the dorsum of the foot also.

The knee is diagnosed from the elbow by reason of the fact that in the former the tuberosity of the tibia is felt, and the prominence is wider and larger, while in the elbow the prominence is much sharper and there is no other determining factor.

When the membranes have ruptured, solid meconium comes away freely. This, which is a sign that the child's life is in danger when the head presents, is of no significance in breech.

X-ray examination. If in extreme doubt, this method of diagnosis may be employed.

Treatment. The first consideration in treatment is the question as to whether version from a breech to a vertex is indicated. Prophylactic version has become now so much the vogue that many obstetricians seem scarcely to pause and consider on its merits or demerits. We refer now to breech as diagnosed in pregnancy or just at the commencement of labour, before the membranes rupture.

There are certain definite contra-indications to external version, viz. hydrocephalus and placenta praevia. In the former an effort of nature has been made to place the largest portion of the foetus in the largest part of the uterus: in the latter, the breech is in the most favourable position for the necessary traction on the foot. When contraction of the pelvis is present, the situation must be weighed carefully, for the after-coming head is sometimes more favourably placed than the fore-coming. These three abnormalities will be considered in their respective chapters. In addition there are two other possible contra-indications to version: (1) Extension of the legs, which will make version difficult. It may not be possible to diagnose extension until this difficulty is encountered. X-rays will be of assistance. (2) The fact which must be borne in mind is that manipulation of the foetus may cause sudden death. This is rare, and is due probably to kinking of the cord by a

limb. When apparently the pelvis and the foetus are normal, should version be done? In considering this point, the skill of the accoucheur must be taken into account, and we are concerned with the case of a doctor who is capable of dealing with a breech presentation and any complication which may arise. In the case of a primigravida, a prophylactic version should be done: the delivery of a breech in this instance may be very difficult, and the head will be to hand if a "Müller" estimation is indicated. When dealing with a multiparous woman, a different situation is encountered: here the delivery should be easy. If, however, the head is easily brought round to the inlet, do version: if there is any difficulty, leave it alone: often, in fact, delivery of the breech will be safer. There is little use in trying external version before the thirty-sixth week: it nearly always recurs, and even when done after that date and before term, the head does not always remain in the pelvis. Therefore, to sum up our ideas on external version for breech presentation:—For a primigravida, turn, except in the cases mentioned above. For a multipara try version: if the head comes round easily, continue, but if there is any difficulty at all, leave as a breech. When the patient has fallen into labour it may still be possible to turn, but the uterus may be so tense that even under an anaesthetic it will be a matter of extreme difficulty. When it is decided to leave as a breech, the treatment is different: (*a*) before the membranes rupture, (*b*) after the membranes have ruptured.

Before the membranes rupture. Keep the patient in bed to avoid premature rupture of the membranes. If they rupture prematurely and the full breech is not filling the lower uterine segment, the cord may prolapse. In addition, the power of the membranes as a dilator of the cervix will be lost.

If the unruptured membranes appear at the vulva, and the os is fully open, puncture them with a boiled stilette.

After the membranes rupture. Watchful expectancy is the keynote in the treatment of breech presentations. In a normal case there is no need to do anything until the breech appears at the vulva.

Some advise bringing down a leg, but such a procedure in a normal case is merely asking for trouble. The slow progress of the breech through the vagina is a necessity, for it dilates the passage for the after-coming head. The *only occasions* when traction should be made on the legs or breech are in the case of miscarriage and when there are indications for immediate delivery: in the former case traction causes extension of the arms, and prevents the head being caught in the cervix. *When the breech appears at the vulva,* get the patient into the cross-bed position: this is the best position for delivery: always have a couple of sterile towels ready; support the perineum as in vertex presentations. If the legs are caught on the perineum, lift them out gently. A warm towel is wrapped around the body, which is now born to the umbilicus. A loop of the cord is pulled down to see if it is pulsating, and to prevent it from being pulled on. If the cord is pulsating, wait until the next pain, and when it comes, the nurse should press on the fundus, and the shoulders will in most instances be born. (If the cord is not pulsating, delivery must be hurried.) After this, the head must be delivered by one of the methods to be described later. If, however, the shoulders are not delivered, the cause must be ascertained, and it will be found that the arms are extended, and they must be brought down.

How to deliver extended arms. First ascertain the position of the back of the child: one of the trochanters is directed forwards. Grasp the feet of the child, draw it slightly downwards to be sure the body is entirely through the lower strait, then draw the body upwards. The important point now is to be sure that the axillae are born. If efforts are made to bring down extended arms early, an unnecessary manœuvre may be carried out, for sometimes they come down spontaneously once the axillae are seen: in addition, the delivery of the after-coming arms is much more simple after birth of the axillae. Pass the whole hand up posteriorly to the bend of the elbow (see Fig. 177), and place the first finger on the bend of the elbow, the second and third on the forearm, and sweep the latter over the face: this is the easiest and the best method, and the arm should not be broken in the procedure. The body should then be drawn downwards,

when the anterior arm will probably be delivered: if not, with the same hand, and in the same manner, bring the arm over the face as an anterior arm. If it does not come easily, turn the child, and make the anterior arm posterior. The direction in which this turning of the body is done is important —it is turned in the direction towards which the hand points

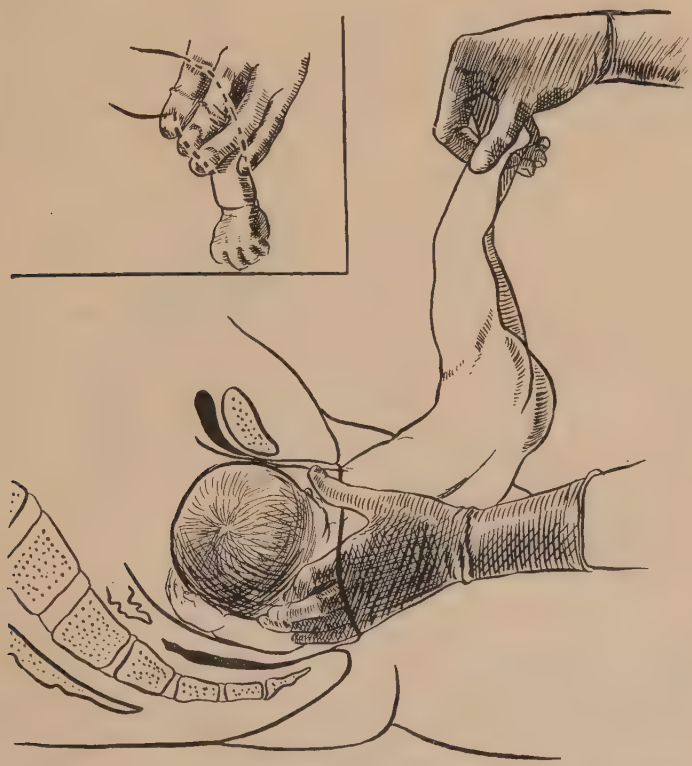


Fig. 177.—Delivery of posterior arm in a breech presentation with extended arms. Inset to show position of fingers on arm.

which is already born (see Fig. 178). Once more we deal with a posterior arm, and the other hand is passed along the back, and the arm is swept over the face in the same way as the other. This is the best method in our experience for dealing with extended arms. Some obstetricians pass the hand along the abdomen: this is, to us, an irrational procedure, for the hand is working in an area where there is but little room. There are, however, some isolated cases where success

is not obtained with our technique, *i.e.* passing the hand along the back. The operator should not hesitate, then, to try the method along the abdomen. Occasionally it may be easy to bring down the anterior extended arm first. Try the best method first : if it fails, try the second or third best. In any twisting manipulations the body should be held in a sterile towel, for it is very greasy and slips from the hands. If the body is twisted in the wrong direction in order to make an anterior arm posterior, the *nuchal* position of the arm may result ; by this is meant that the arm gets encircled around the back of the neck : this effectively prevents

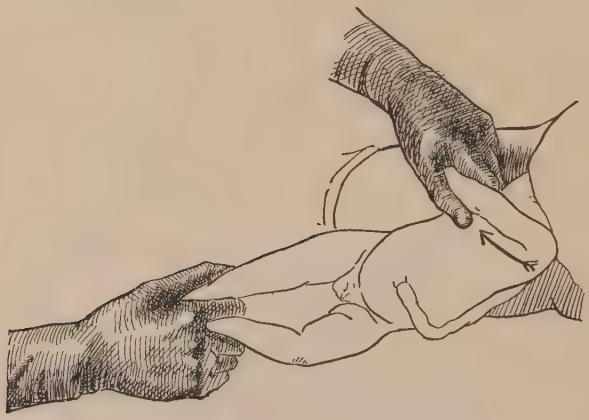


Fig. 178.—Breech. Extended arms. Making anterior arm posterior.

delivery, and the arm must be brought down. The hand must be placed in the vagina, and the exact position of the arm around the neck noted ; the body is then turned in the direction in which the nuchal hand points : this will free the arm, but it may remain extended, and must be brought down.

Delivery of the head. The head is scarcely ever born spontaneously, and nearly always needs assistance. Unless in minor degrees of contracted pelvis, the diagnosis of which has been missed, the child should never be lost, and the after-coming head is easily delivered if the delivery is done carefully and cautiously ; and while speed is essential, it is wise to hasten with deliberation. The main principle is to deliver the head flexed, for if efforts are made otherwise, a

very large diameter will engage. When the head is flexed, the suboccipital-frontal diameter (10 centimetres) is involved, while the supraoccipitol-mental diameter must come through if the head be extended. Our object, then, is to perform a manœuvre to cause flexion. There are scores of methods in vogue, with scores of names. We shall only describe two: (1) the Smellie-Veit-Mauriceau, (2) the Prague. Each of these should be assisted by pressure on the head from the abdomen.

With regard to choice of methods. If the head is not

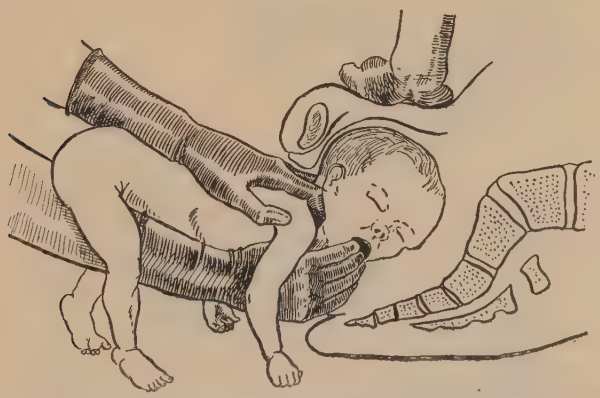


Fig. 179.—Delivery of after-coming head by the modified Smellie method. (Smellie-Veit-Mauriceau.)

well down, the Prague method is probably the better: when the head is low, the Smellie method is to be preferred.

The Smellie-Veit-Mauriceau method (see Fig. 179). Get the child straddle-leg over the arm, put one or two fingers to the back of the mouth, get the fingers of the other hand over the shoulder, while the assistant presses on the abdomen. The fingers in the mouth cause flexion, the fingers over the shoulders cause traction, the pressure from above will deliver.

The Prague method (see Fig. 180). Grasp the feet with the first finger between the ankles, the thumb and second finger holding the legs; the fingers of the other hand grasp the shoulders, as illustrated, remembering again the value of pressure from the abdomen.

In this case the fingers over the shoulders cause the

flexion by bringing the occiput against the pubes, the fingers over the legs deliver by traction.

Forceps delivery. If neither of these methods is of avail, forceps, which should always be boiled in readiness, should be tried. We believe this method is more difficult and less

Fig. 180.—Delivery of the head by the Prague method. It is better to place the first finger between the feet or their flexor aspects, the thumb and second finger grasping them just at the ankles.

effective, but some obstetricians advocate it to a large extent. They should be applied carefully to each side of the head.

The delivery of the after-coming head at times involves the greatest difficulty, and the expenditure of considerable muscular force. It is most important to remember to have at hand a sterile towel, but if this is not available, wind a strip of iodoform gauze around the shoulders and chest in the manner adopted by children in playing horse. This will give a hold which adds greatly to the available power. If

traction and suprapubic pressure do not succeed in delivering the head, discontinue the attempt for ten to fifteen seconds. This gives the head a chance to mould, when delivery can usually be effected.

If the occiput is posterior. Twist the child, and the occiput will become anterior. If this fails, the Prague method will succeed in rolling out the head face to pubes.

Delivery of breech presentation in various varieties of contracted pelvis. This will be referred to in the chapter on Contracted Pelvis.

Complications of breech.

(1) **Extended legs.** These prevent the normal lateral flexion of the body, and may interfere with delivery. They increase the girth of the body and make the delivery of the head more difficult by reason of the fact that the head and feet come down together. Extended legs may also displace the arms upwards, thus leading to the probability of extended arms during birth. If natural delivery does not occur, the treatment is the same as for impacted and arrested breech.

(2) **Impacted breech.** This may be an exaggeration of the above. By it is meant that the breech is impacted in the pelvic cavity. It is caused either by (*a*) some contraction of the pelvis, or by a tumour; (*b*) some fault in the soft parts such as uterine fibroid or vaginal tumour; (*c*) excessive size of the baby, or monster.

It is important to remember that it may occur in a multipara or a primigravida, and that an easy confinement on the first occasion does not ensure the same at the next labour. We have met this abnormality more often in a multipara than in a primigravida.

(3) **Arrested breech.** By this term is meant that the breech is arrested above the pelvic brim. The causes are the same as those of impacted breech already enumerated. The symptoms and treatment of the two will be considered together.

Symptoms. The breech fails to advance. The temperature rises, and the pulse becomes fast. The foetal heart rate is above 160 or below 120, a large caput forms on the breech, and makes diagnosis difficult. The uterus becomes hard and tense, the pains become more frequent,

until they are nearly continuous; in fact the symptoms of threatened rupture of the uterus are present. All these points must be considered with care, when it will be found that if "something" is not done, the uterus will rupture, and the baby will die.

Treatment. The first principle in treatment is to diagnose the cause of the abnormality. If contraction of the pelvis is present, a thorough examination of the size of the pelvis and of the baby must be made to determine the next step. If there is no contraction, the different

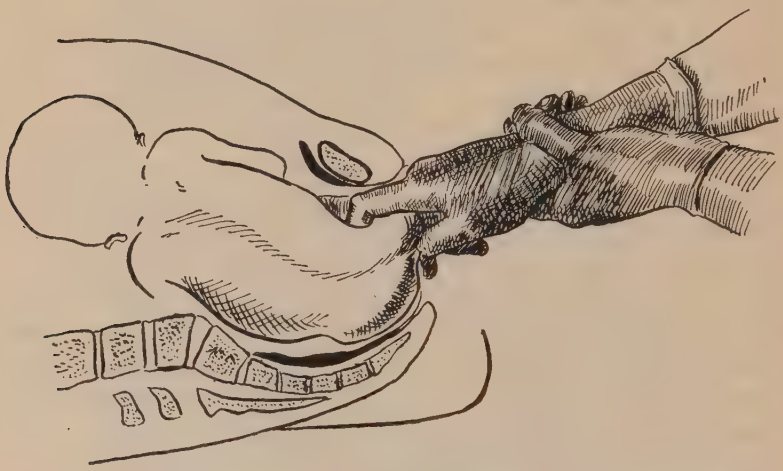


Fig. 181.—Impacted breech. Delivery by traction with finger in groin with help of other hand.

methods of delivery must be considered. Delivery must be effected by traction without much manipulation, for any strong manipulative efforts would result in rupture of the uterus. To take a given case with the symptoms and signs as stated above, what are the possible treatments?

Excluding such conditions as contraction of the pelvis, we must aim at direct delivery of the breech. What means can be considered? (1) Traction with a finger in the groin; (2) traction with a finger in each groin; (3) the passing of a fillet; (4) pushing up the breech and bringing down a foot; (5) forceps; (6) blunt hook.

(1) *Traction with finger in the groin.* This is the best method of dealing with an impacted or arrested breech.

The first finger should be hooked into the anterior groin, and should be pressed well home, for if it is inclined to exert pressure on the femur, it will probably fracture it. If traction by the hand alone does not succeed, if the wrist of this hand is grasped by the other (see Fig. 181), success may be achieved. The anterior groin is preferred to the posterior, for if the latter be chosen, the former may override the pubes: sometimes, however, the posterior groin is easier to reach, and traction on it may be tried. An assistant should exert pressure on the fundus.

(2) *Traction in both groins.* Sometimes this succeeds when traction on one groin fails. In this method the first finger of each hand pulls on each groin.

(3) *Passing a fillet.* After failure by either of above methods, a fillet of gauze is passed: this can be done in one of two ways. Either use the fingers alone or a catheter. When the fingers alone are used, a piece of wet iodoform gauze six inches wide is passed up between the child's thighs or outside one thigh. If this cannot be done, use a No. 12 or No. 4 male catheter.

Push a doubled piece of silk up it by the stylet and pull a loop out of the eye of the catheter. Leave the stylet in and bend the end of the catheter to a hook. Pass the bent catheter up between the child's thighs, guiding it by a finger in the vagina. Turn the hook over one or other of the thighs. Now slowly withdraw the stylet, keeping the catheter in position. Push the catheter further up. The concavity of the curve is in this way pressed over the child's groin. The bend increases and the tip of the catheter descends more and more down the outer side of the foetal thigh. Push the fingers up the outer side of the thigh to meet the catheter. Guide it out of the vulva with the tip of the finger placed on the tip of the catheter, still pushing the stem up to allow the tip to progress. Tie a piece of iodoform gauze to the loop of silk and draw it to the eye of the catheter. Pull the gauze over the thigh by withdrawing the catheter.

There is now a piece of gauze passing over the thigh (see Fig. 182). Next push it well into the groin. This is essential, for, unless it is actually placed in the groove of the groin, it

is extremely liable to break the thigh. Pull with the pains, whilst the nurse presses on the fundus. Once traction with the fingers or the fillet has delivered the breech to the navel, the treatment becomes one of ordinary breech. If the breech is impacted low down, a fillet can almost certainly be passed with the fingers alone. If the breech cannot be drawn down in any way, and it is high, the best thing to do is to—

Fig. 182.—The fillet in impacted breech.

(4) *Push up the breech and bring down a foot.* This must only be done when signs of threatened rupture of the uterus are not present, for it is just as easy to rupture the uterus with this sort of manœuvre as if a definite version were attempted. This manipulation is easy to perform and merely consists of catching the foot. The method of delivering the breech by traction is described in the chapter on operations (p. 594).

(5) *Forceps.* Forceps may be applied to the breech either to deliver or to bring down low enough to pass a fillet. There is said to be some danger in this method of rupturing the liver. We have used it on a few occasions

with success, but it should only be considered after the other methods have failed.

(6) *The blunt hook.* This should never be used on the living child: it tears the thigh muscles. When the baby is dead, its use may be necessary, but even then it is inadvisable, for it is apt to lacerate the soft parts of the woman.

THE MECHANISM OF BREECH PRESENTATIONS

The movements that occur in breech presentations are—

(1) Engagement and descent.
(2) Internal rotation.
(3) Lateral flexion of the body.
(4) Restitution.
(5) External rotation.
(6) Birth of head by movements of—
  (*a*) Flexion with descent.
  (*b*) Rotation.
  (*c*) Maintained flexion.

When the back is posterior, the occiput is directed posteriorly and the head is born by bringing the body over the abdomen; thus it is born flexed, the occiput, brow, face and chin appearing in order.

There is little to explain in the above mechanism. The bitrochanteric diameter (10 centimetres) engages in one of the oblique diameters, one hip descends more quickly than the other, and the anterior one comes to lie under the pubic arch, the bi-trochanteric diameter now lying in the antero-posterior diameter of the outlet.

After rotation, descent continues, after which a movement of lateral flexion of the body drives the anterior buttock over the perineum; this escapes at the vulva, and is followed by the posterior buttock, which, after stretching the perineum, is born. The shoulders with the bi-sacromial diameter, 11·5 centimetres, were in the same oblique diameter as the bi-trochanteric diameter, but have not followed the latter into the antero-posterior diameter. Immediately restitution occurs, which brings the bi-trochanteric diameter into proper relation with the bi-sacromial. External rotation brings the back more to the front. The rest of the body follows quickly up to the head, which is now in one of the

oblique diameters: internal rotation of the occiput occurs, and the head is born by flexion. The birth of the head nearly always requires assistance. There is very little obvious moulding or caput in this presentation. The genitals may be oedematous.

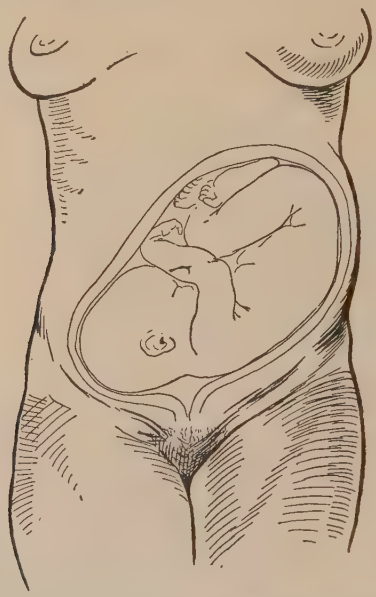


Fig. 183.—Obliquity of the uterus causing transverse (oblique) presentation.

TRANSVERSE OR OBLIQUE PRESENTATION OR CROSS-BIRTH

This presentation is an extreme example of the necessity for antenatal care, for a correction of this abnormality which may be serious to both mother and child can be made before labour starts. If transverse or oblique presentation persists, it is most important that it should be recognised and treated: the former is not common; the latter may be a transitory occurrence before labour starts, which rights itself with labour pains. If either is present at the start of labour, the presentation must be changed.

Frequency. In seven years at the Rotunda the average was 1 in 280.

Causes. These will be found in the pelvis, the uterus, and foetus.

The pelvis. **Contracted pelvis** favours this, as well as

other malpresentations. A bony tumour, by preventing the presenting part from entering the brim, will do likewise.

The uterus. Obliquity of the uterus may push the head into the iliac fossa of the opposite side (see Fig. 183). Tumours of the uterus may cause this, or any other malpresentations. The slack uterus of multiparity is less likely to maintain a foetus in its proper position than the firm uterus of a primigravida.

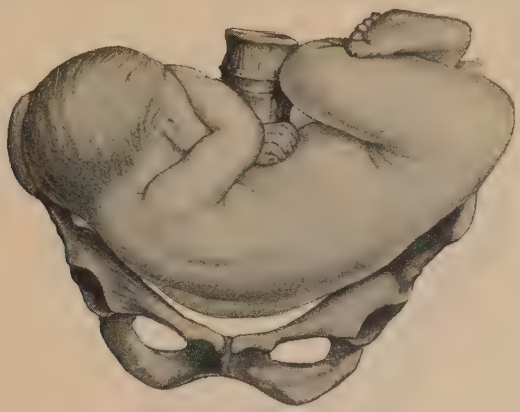


Fig. 184.—Transverse II.

Placenta praevia. In this, the lower uterine segment is soft: this prevents the head from engaging, and a transverse lie may result.

The foetus. The head of a very large child may not become fixed in the brim. In the same way, a very small child may behave in a similar manner: one of twins, especially, may be transverse. A dead foetus is not inclined to fix, and moves freely about: this free movement predisposes to abnormal presentations. Hydramnios favours malpresentation by preventing fixation.

Varieties (see Figs. 184, 185). We describe four varieties: (1) Head to the left, back in front. (2) Head to the right, back in front. (3) Head to the right, back behind. (4) Head to the left, back behind.

Some authorities divide these positions into (1) Dorso-anterior with the back in front, (2) Dorso-posterior with the back behind.

Diagnosis.

Inspection. The shape of the abdomen is more transverse or oblique than normal: it is very wide at the flanks.

Abdominal palpation.

Fundal grip. It is found that there is nothing actually in the fundus. On bringing the hands down to the position of the

Umbilical grip, the great width of the abdomen is apparent, but it is the

Pawlik grip which decides the diagnosis.

Fig. 185.—Transverse III.

Either there is nothing at all in the pelvis, or else a head or breech is apparent in either iliac fossa.

It is necessary to determine the position of the head, and this is often more difficult than discovering its absence from the brim. The head often lies in one or other iliac fossa, and the abdominal muscles over it, being sometimes stretched and hard, obscure its outline. The head is either in an iliac fossa or somewhere near the fundus, more rarely in one or other loin. It is distinguished as it is in breech presentation: namely, (1) by ballotting it separately from the back; (2) by the groove of the neck separating it from the back; (3) by its hardness and size. Palpation is often difficult, and the information derived from it unsatisfactory.

Rectal examination will determine the absence of a presenting part, but a

Vaginal examination is usually necessary in this class

of case. Unless the arm is prolapsed, the fingers in the vagina cannot feel the presenting part. The unsupported membranes bulge with the pains and are very liable to rupture early. In short, there are three warnings that something is wrong. It is very important to make an accurate diagnosis. Therefore put the half or whole hand into the vagina, giving chloroform, if necessary. Upon an exact determination of the lie depends the best method of successful treatment.

Usually the shoulder lies over the os. At first the shoulder may be mistaken for a sacrum or knee. But it can be distinguished by tracing the outline of the axilla, and by feeling the acromion process and spine of the scapula. The position of the scapula, whether anterior or posterior, determines the position of the back, and so the lie of the child. Recognition of the ribs is also characteristic.

Later an arm will often be found to be prolapsed. When the hand is in the vagina, there is no difficulty in distinguishing it from a foot. Grasping the hand, as in shaking hands, enables one to recognise the position.

The importance of the lie is obvious. If the back is directed downwards and the limbs upwards, it is far more difficult to catch a leg than if the back is up towards the fundus and the limbs are in the neighbourhood of the internal os.

Treatment.

Antenatal care. Once this has been recognised, a full examination of the pelvis for contraction and for the other causes of transverse presentations must be sought.

The recognition of this abnormality in an antenatal clinic, and its correction, must have diminished the number sent into a maternity hospital. When seen after the thirty-sixth week, or any time before labour starts, the position must be changed either to a breech or vertex. Generally speaking, we advise change to the pole nearest to the pelvic brim. The method of performing external version is described on p. 587.

It must be remembered that malpresentation may, and does recur. In that event it is best to wait until the commencement of labour, to do external version again and to

apply a tight binder: this usually suffices, but if the transverse lie returns, the case may be left until further labour, when it should be dealt with as described below.

In labour. If there is no contra-indication, external version should be done, and the head or breech brought into the pelvis, after which a tight binder is applied. We advise bringing the pole which is nearest to the pelvic inlet; if this is successful, there is nothing else necessary: if, however, it is unsuccessful, treatment as below must be carried out.

Before the membranes rupture. When the os admits two fingers, the best procedure is to rupture the membranes and bring down a leg. On no account should delivery be concluded, but the patient is left to deliver herself. If forcible deliveries were carried out at this stage, a dangerous and possibly fatal haemorrhage would result.

When the os is from two fingers to three-quarters dilated, the same treatment is carried out.

When the os is fully dilated, the foetus is turned and delivered by traction.

The only exception to the above treatment is when the cord is prolapsed: in that case the child may be delivered slowly and carefully even when the cervix is only three-quarters dilated: when it is smaller, labour should not be terminated.

After the membranes have ruptured. This is the type of case which requires deep thought and consideration, even by the experienced obstetrician. Generally speaking, if symptoms of threatened rupture of the uterus are not present, version should be done. There are, however, border-line cases, when it is difficult to determine whether version can be done with safety. If the membranes have just ruptured there is no need to worry, podalic version is safe: if, however, they have ruptured for some time and the uterus is somewhat contracted on the child, the question as to the safety of version may be difficult to decide. We have no difficulty in advising what to do. The question of version is decided by the foetal heart: if there is nothing abnormal in the rate and volume, version is safe, for the placental site has not been encroached on sufficiently to endanger the life of the child, therefore it may be taken that

the lower uterine segment has not been stretched enough to cause rupture if version is performed. If *such an extreme* rarity is encountered where the child is alive and rupture of the uterus appears certain if version is done then, the lower segment Caesarean operation is the choice. If the child is dead, decapitation is the treatment. We advise decapitation by the blunt hook and scissors method, which is described on p. 623. Sometimes, where a true transverse is the presentation and the child is dead, the neck cannot

FIG. 186.—Spontaneous evolution (after Bumm).

be reached: in that case spondylotomy is done, *i.e.* the body is divided through the abdomen and vertebrae. When the child is very large and dead, evisceration and craniotomy are sometimes necessary in addition.

There is usually no mechanism, for a change of the presentation is nearly always necessary. Occasionally, however, when the child is very small or macerated, it may be born alive by one of the mechanisms stated below.

(1) Spontaneous version.
(2) Spontaneous evolution.
(3) Spontaneous expulsion, or Corpore conduplicato.

There is nothing to say about spontaneous version. Spontaneous evolution (see Fig. 186) as described by Douglas is like the over-arm swimming stroke. The foetus gets moulded into the pelvis and the shoulder presents. Later, unless correction is made, the shoulder descends further and the arm prolapses. The further mechanism usually results in rupture of the uterus. If, however, spontaneous evolution occurs, the head remains in one iliac fossa, with the breech at the opposite sacro-iliac-synchrondrosis. Great stretching of the neck allows the arm with its corresponding shoulder to prolapse further until the latter appears under the pubic arch, and the chest, following the breech, is born. The remainder of the chest and other arm then appears. The head is delivered as in breech presentation.

In the spontaneous expulsion, or Corpore conduplicato, the child is born doubled on itself, the shoulder appearing first at the vulva.

COMPOUND PRESENTATIONS

The most common of these is prolapse of a hand beside the head, or a further stage may be reached when the arm comes down.

Occasionally both hands may prolapse, and the cord may come down in any of these complicated presentations.

This group must be treated first.

When the hand is found beside the head, an effort should be made to put it up by flexing the elbow: if this fails, allow labour to proceed, when natural delivery will follow—or possibly forceps may be necessary.

When the arm is down beside the head, always make certain that the case is not one of transverse presentation. Having excluded this, an effort should be made to put the arm above the head: this is done by gently pressing on the elbow: should this fail, decision must be made as to the likelihood of natural delivery following: if this seems likely, do nothing: if, however, it seems unlikely, and there are no contra-indications, bipolar version should be done.

When both hands are prolapsed, the obvious primary diagnosis is transverse presentation: this having been excluded, the most likely cause of the trouble is an anence-

phalic foetus. This is easily diagnosable on vaginal examination, and if delivery does not occur naturally, traction on the arms will be effective. If both hands prolapse beside a full-term head, it will be necessary to push up at least one of them before delivery is possible.

If the cord is prolapsed beside the head, the treatment should be carried out as described on p. 391.

The condition of face, hand and cord, described elsewhere, and the treatment also will fall under "Prolapse of Cord."

When a foot prolapses beside the head, the presentation is distinctly complicated. It is extremely rare, and can only occur in the case of a large pelvis and a premature child. Unless the labour is very advanced, the best treatment is to put up the head and bring down a foot (podalic version). If labour is very advanced, it will probably be easy to push up the foot and deliver the head.

Other compound presentations may occur, but they are rare. On considering such cases, it will be found that the treatment will fall under one of the headings already enumerated.

CHAPTER XVII

LABOUR : ITS ABNORMALITIES (*continued*)

Labour with Malformed Children—Prolapse of the Cord—Multiple Pregnancy.

UNDER the first heading come : (1) hydrocephalus, (2) anencephalus, (3) spina bifida and meningocele, (4) monsters, (5) foetuses of abnormal size, (6) abnormally large shoulders.

HYDROCEPHALUS

Frequency. The average rate of occurrence of hydrocephalus estimated over seven years was 1 in 1142.

Nature. When there is an excessive amount of cerebrospinal fluid, which is usually in the lateral ventricles of the brain, the cranium is stretched and enlarged. The condition is known as hydrocephalus. Its cause is not known.

The cranium above Reid's base line is formed of bone ossified from membrane. In the full-term foetus, ossification is complete except at the sutures and fontanelles. When hydrocephalus exists, ossification fails to keep pace with the distension of the cranial membrane. Consequently the fontanelles and sutures of a hydrocephalic skull are far larger and wider than normal.

The fluid causing hydrocephalus may be enclosed in the cerebral membranes, but outside the brain, or it may be contained in the cavities of the ventricles—external and internal hydrocephalus. The latter is the more common form.

Course. The large head does not fit the lower uterine segment. Malpresentations are therefore common. Breech presentation is especially common, and transverse not infrequent.

If the head lies over the brim there is especial liability to obstructed labour, leading to rupture of the uterus. The head does not mould to the pelvic brim, but tends to

flatten out when forced downwards by the pains. Obstructed labour results. The lower uterine segment is stretched over the large head, and this, combined with the tugging of the upper muscular segment, causes rupture of the lower segment.

If the breech presents, the prognosis is more favourable. The soft after-coming head is compressed as it passes the pelvic brim and canal and stretches out into a long cylinder, which passes almost as easily as a normal after-coming head.

Diagnosis.

Abdominal palpation. The abdomen appears larger than normal, and an abnormally large head is felt either in

Fig. 187.—Hydrocephalus. (Rotunda specimen.)

the fundus or in the pelvis: if in the latter, it is not fixed. It is impossible to span it by the Pawlik grip; in addition it feels very soft, and sometimes a pitting or crackling can be obtained.

Rectal examination will be of little use, for the presenting part is very high up.

Vaginal examination. It is usually necessary to pass the half hand into the vagina in order to reach the head. In hydrocephalus the bones give a distinct feeling of crackling, a sign which is sometimes felt on palpation. The parietals are widely separated, the sutures being wide with no moulding whatever. The fontanelles are enormous, and the bulging fluid may be mistaken for the membranes or even for the soft parts of the foetus, *e.g.* breech. The membranes are diagnosed by the fact that they can be moved over the bones.

Our suspicions of hydrocephalus are aroused when obstructed labour occurs with a vertex presentation, in a woman who has given birth to full-time living children. It sometimes happens that forceps are applied before this condition has been definitely diagnosed; if it should be found that the forceps do not lock owing to the obvious spreading of the blades, a diagnosis of hydrocephalus, doubtful before, now becomes assured.

Treatment.

Before signs of obstructed labour. If hydrocephalus is diagnosed with the vertex presenting, turn the child and

Fig. 188.—Hydrocephalus treated by catheterisation.

bring down a leg. The head is more easily delivered as an after-coming than as a fore-coming head. If the diagnosis of hydrocephalus is wrong, no great harm is done. If it is impossible to perform version, perforation should be done.

If the after-coming head is very large, run a silver catheter (see Fig. 188) from the highest convenient vertebrae (cervical if possible) up to the ventricles. If a spina bifida is present (and it is a fairly constant accompaniment of hydrocephalus), pass it up from there: if not, cut with scissors or a knife into the cervical vertebrae and pass it up from that situation. The cerebrospinal fluid escapes through the catheter, and the shrunk head can then be delivered. This is a simple operation attended by most satisfactory results; care must be taken to keep in the middle line or the chest will be entered.

After signs of obstructed labour have arisen. By combined vaginal and abdominal examination, the vertex may be found on the perineum, while the face will reach almost to the umbilicus. Do not wait for the signs of obstructed labour to become marked, for, as has already been noted, the lower uterine segment is especially liable to rupture. Perforate the head, if a vertex, or draw off the fluid with a trocar and canula. If the shoulder or breech presents, treat according to the rules for these. It is better to perforate a hydrocephalic skull than to subject the mother to risk. A child with hydrocephalus has not

Fig. 189.—Anencephalus. (Rotunda specimen.)

the same vital value as a normal one, and is nearly always stillborn. If it lives, it is liable to become an unsightly imbecile.

Anencephalus or Hemiencephalus (see Fig. 189). This abnormality occurred 19 times in seven years, or an average of 1 in 721.

Some believe that this is a late stage of hydrocephalus. The stretched vault of the latter bursts, and the vaultless head of anencephalus results. Cerebral dropsy has been cited as a possible cause. There are other possible aetiological factors. The whole of the cranial vault is missing, and the brain. Sometimes the cleft extends to the arches of the vertebrae as far down as the lumbar region, where there may be absence of the spinal cord. Instead of the cord

there may be a whitish membrane, while a mass like granulation tissue is found in place of the brain.

For a full description of this and other foetal deformities the reader is referred to Birnbaum and Blacker on *Malformations of the Foetus.*

Diagnosis. This may be a matter of extreme difficulty, and it is not until the whole hand is placed in the vagina that a diagnosis can be arrived at. It is often difficult to diagnose from a face or a breech, but the hand in the vagina will soon decide the diagnosis. Hydramnios is often an accompaniment.

Course of labour. This usually is spontaneous unless the shoulders are very large. A transverse lie must be diagnosed when present.

Treatment. Transverse presentation must be changed. If, as occasionally happens, two hands come down with the anencephalic foetus and labour is prolonged, they may be drawn on, and the head will follow. If the shoulders are very large, and become impacted, bring down one arm at a time, or else do cleidotomy.

If there is any great increase in the size of the body, it may be necessary to eviscerate.

SPINA BIFIDA

Spina bifida is a hernial protrusion of the membranes of the cord through undeveloped vertebral arches. It may occur in the dorsal, lumbar, or sacral region, or it may protrude inward towards the abdominal cavity. The nearer the tumour is to the sacrum, the less serious is the condition. These tumours are at times well covered by skin, but more often the skin is very thin and the bluish-red sac appears on the point of rupture. The nerve tissue of the cord may be spread over and intimately associated with the sac, which has a great tendency to ulcerate. If it does, the child nearly always dies from loss of cerebro-spinal fluid, or from infection.

The diagnosis is made as a rule only when the body of the breech is born : its presence may be surmised in hydrocephalus, and it can sometimes be found on a manual exploration of the vagina.

Treatment. There is no treatment before birth, except in the case of hydrocephalus, when the treatment already outlined should be carried out.

After birth, operation, which is sometimes successful, when the abnormality is low in the lumbar or in the dorsal region, may be done. Descriptions of this will be found in text-books of surgery.

MENINGOCELE

Meningocele is a hernia of the membranes of the brain, just as spina bifida is a hernia of the membranes of the cord. If the hernia contains brain matter it is known as encephalocele. It is unlikely to give rise to obstruction in labour.

MONSTERS

Among 13,700 births during seven years in the Rotunda, there were three monsters—1 in 4566.

Nature. Monsters are either single or double. The first rarely give rise to any difficulty, for they are usually small and ill-developed.

Double monsters are more likely to give trouble.

They are either two foetuses loosely joined, two closely joined, or a monster with two heads and two legs or one head and four legs. They do not by any means necessarily cause difficult labour, and, being small, are usually born without difficulty.

Diagnosis. Make the diagnosis by putting the whole hand into the uterus when the patient is anaesthetised.

Treatment. When the diagnosis of double monster is made, pull down one leg. If delivery cannot then be accomplished, amputation of the limbs or other mutilating operations must be performed.

FOETUS OF ABNORMAL SIZE

Cause. Over-carrying. This is the commonest condition found. It is often encountered, and must be carefully looked for in an antenatal clinic. At the same time, care must be taken not to treat the case as one of over-carrying relying only on the menstrual history: other clinical data

must be looked for to confirm the diagnosis: otherwise induction may be carried out unnecessarily.

Symptoms and signs. The patient gives a history of being over her time according to the menstrual history. There may be a history of the birth of one or more enormous dead babies.

On examination, the abdomen will be found to be very large. The skull bones are very hard and the fontanelles are difficult to distinguish.

Treatment will depend on the relation of the size of the baby to the size of the pelvis.

In most cases, *induction* at term is indicated. Otherwise the treatment is carried out on the lines laid down in the chapter on Disproportion.

Other Foetal Abnormalities. The foetus may have ascites, hydrothorax, cystic kidneys, a very large bladder, cystic hygroma of the neck, or other tumours which obstruct delivery. A general dropsy may cause the foetus to be of abnormal size.

Diagnosis. Diagnosis can only be made by putting the whole hand into the uterus. This manipulation is indicated on finding that the head or legs enter the pelvic cavity, but progress ceases. Anaesthetise the patient and insert the whole hand into the uterus to find out what is preventing the rest of the foetus from passing the brim.

Treatment. The foetus may be born without trouble. If dystocia arises, it must be treated; *e.g.* for foetal ascites, the abdomen should be punctured.

Cleidotomy can be done for large shoulders, craniotomy for an excessive size of the head.

IMPACTED SHOULDERS

This may occur when the head or the breech presents. The diagnosis and treatment when breech presents are given on p. 366.

When the head is born, but the rest of the foetus does not follow, the shoulders are impacted. This often arises from failure of rotation of one shoulder to the front, due to premature pulling on the head. The attendant thinks the presentation is Vertex I, and as soon as the head is born,

he pulls on the head, and tries to twist it as it would turn in Vertex I. If the presentation is one of Vertex II, his efforts twist the shoulders the wrong way; they become transverse and impacted.

Treatment. First see that the two shoulders are not coming together: if they are, put one up and deliver the other. If this is of no avail, pass the half hand between the mother's sacrum and the child. Take hold of the posterior arm with as many fingers as possible, and bring the arm out of the vulva over the child's chest. If the anterior arm cannot be brought down, pull the delivered arm over the child's chest and twist the child in a half-circle. The anterior arm becomes posterior, and is delivered like the first arm. Sometimes twisting is easier if the child's head is pushed up towards the vagina, as this frees the anterior shoulder. Traction on the head facilitates delivery of the arms. After the birth of the arms, the shoulders quickly follow.

Some obstetricians have recommended decapitation when the child is dead, as a method of treatment. In our experience the head is useful as a tractor, and the method as described above is the best.

Cleidotomy may be considered as a treatment, but it should not be done unless the child is dead, for it is difficult to avoid injuring the large blood vessels. When the child is dead, it is an excellent form of treatment.

PROLAPSE AND PRESENTATION OF THE CORD

In 13,511 deliveries in seven years at the Rotunda Hospital there were 75 cases of prolapsed cord, or 1 in 180. Of these, 39 were born alive. Of the dead, 3 were macerated. In 13 other cases the cord had stopped pulsating when discovered, and no treatment was undertaken.

Definition. When the umbilical cord can be felt by vaginal examination through the unruptured membranes, the cord is said to *present*. If after the rupture of the membranes the cord comes down in front of or with the presenting part, the cord is *prolapsed*.

Causes. Prolapse of the cord is impossible if the lower uterine segment grasps the presenting part. Therefore the

causes of prolapse of the cord are those that lead to a communication of the after-waters and fore-waters, namely, that the presenting part does not accurately fit the lower uterine segment. The membranes bulge through the os. This bag bursts, much of the after-waters rush out; they carry the cord, which was perhaps presenting, with them, and prolapse results.

We have dealt with several of these cases already: (1) brow, (2) face, (3) breech, (4) cross-births, (5) twins, (6) hydrocephalus, (7) hydramnios. Another cause which prevents the presenting part from coming down to the lower uterine segment and so makes a prolapsed cord possible, is (8) contracted pelvis, the commonest cause of all. The lower uterine segment is below the pelvic brim, and consequently, in contracted pelvis, the head not entering the brim fails to fill up the lower uterine segment. (9) Tumours preventing descent of the presenting part.

Danger. A prolapsed cord does not add to the risk of the mother, except the risk from the operative procedures necessary for rapid delivery. The head presses on the cord and stops its circulation. In breech cases, the breech does not compress the cord as dangerously as does a forecoming head, but prolonged pressure of the breech on the cord is injurious, and the cord should be replaced.

Diagnosis. When the cord prolapses, it frequently appears at the vulva. At times it can only be diagnosed by vaginal examination. The importance of recognising this condition is so great, that whenever the presenting part is not fixed, a vaginal examination should be made immediately after rupture of the membranes, to see if the cord is prolapsed. When the cord is felt, it cannot well be mistaken for anything else. Carefully notice if it is pulsating, and if it is, count the number of pulsations.

Treatment.

Before rupture of the membranes—presentation of the cord. The question of disproportion and the possibility of the necessity for Caesarean section must always be borne in mind: in the absence of disproportion, if the cord has come down to one side of the presenting part, get the

patient to lie on that side. The fundal pole of the foetus then falls over to the side on which the patient lies. The presenting pole swings a little in the opposite direction and so does not press on the cord. How much good this does one cannot say, but it is worth trying. Many writers advise bipolar version, on the ground that, if the cord prolapses, it is safer for the child to be born by breech than by vertex. We, as a rule, wait until the membranes rupture and the cord prolapses, as we find the cord can sometimes be replaced with success.

After rupture of the membranes—prolapse of the cord. First try to diagnose the size of the pelvis and the amount of disproportion. If the patient is a primigravida with small measurements, and the os is the size of two

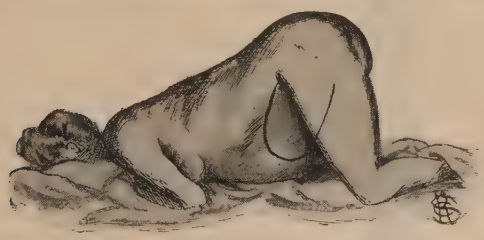


Fig. 190.—Knee-chest position.

fingers, Caesarean section must be thought of: if so, the operator must be satisfied that the baby is alive before operating.

If section is not indicated, the following procedure should be followed:

Take the cord between two fingers and feel if it is pulsating. If it is not pulsating, it is not necessary to replace it. If it is pulsating, treatment depends on the size of the os. When the size is between that of a two-shilling-piece and nearly three-quarter dilatation, put the patient in the knee-chest position while preparations for interference are in progress, then either replace the cord or do bipolar version when a head presents, or bring down a foot when the breech presents, for then there is less chance of pressure on the cord. When the os is three-quarters dilated it is justifiable to deliver immediately, and this can be done by version and extraction or forceps in the case of a head presentation, or extraction

when the breech presents. When the os is fully dilated the same treatment applies.

Replacing the cord. The replacement of a prolapsed cord that has protruded through the vulva is, of course, attended with some danger of sepsis. Put the patient in the cross-bed position with a pillow under her buttocks. Chloroform, as a rule, is essential. Pass the whole hand into the vagina and gather up as many loops of the cord as possible in the palm of the hand. Lift them up to the os and attempt to push the cord bit by bit past the presenting part. It may be possible to use a large handful of iodoform gauze to push up the cord, and this can be left in position for a few minutes, after which it is removed. Manual replacement in conjunction with the one to be described very often results in successful replacement of the cord.

Fig. 191.—Catheter and loop of silk, used as a repositor.

Pull a loop of cord out of the vulva. Take a No. 12 or No. 14 male catheter for a repositor. Push a loop of sterile silk through it with the stylet. Pull the loop out of the eye of the catheter. Pass this loop round the cord and then pass it again into the upper niche of the eye-hole of the catheter, and fix it there by pushing the stylet home through the loop. Draw the loop of silk tight enough to hold the cord loosely, but not compress it. Guiding the catheter with fingers in the vagina, push the catheter into the uterus up to the fundus. This carries a considerable length of cord into the uterus, and then, with the hand in the vagina, hook any remaining part of the cord over the most prominent foetal parts. The nurse or an assistant pushes the presenting part down into the brim to occlude the passage through which the cord has slipped. Withdraw the stylet and then withdraw the catheter. This frees the

cord. Do not remove the hand from the vagina until the catheter has been withdrawn. Feel that the presenting part has been pushed into the brim and that the cord has not again prolapsed. Unfortunately, in some cases, the cord again prolapses. Some have, therefore, advised leaving the catheter in the uterus, but practically this has been found to incur a great risk of strangulation of the cord in the loop of silk.

If the cord prolapses when released, replace once more by means of the repositor.

MULTIPLE PREGNANCY

TWINS

Frequency. In 13,511 deliveries at the Rotunda there were 187 cases of twins, or 1 in 72.

Cause. Twins may be either Binovular or Monovular.

Binovular twins arise from the fertilisation of two ova. These two ova may come from one Graafian follicle, or from two Graafian follicles. The babies may be the same or different sex: if different they must be binovular. There may be two placentae and two sets of membranes, but the two placentae may be in contact.

Monovular twins arise from a single ovum with two germinal nuclei or from two embryonic areas. It has also been suggested that one embryonic area may divide into two. The babies are always the same sex. There is one placenta, one chorion, one or two amnions and two cords.

A doctor is often asked if twins will have twins. This is uncommon, although it does occur. It is more usual to skip a generation, and for the child of a twin to be the parent of twins.

Presentations. Twins present in the following different ways, given in the order of frequency: (1) both head; (2) one head, one breech; (3) both breech; (4) one head, one transverse; (5) one breech, one transverse; (6) both transverse.

Diagnosis. The presence of twins may be suspected in the early months by the fact that the uterus is larger than the time of pregnancy indicates, *e.g.* when the patient is four months pregnant, the uterus is at the umbilicus.

Labour often comes on prematurely, but if pregnancy goes to term, the uterus is larger than normal, and the abdomen is over-stretched.

Twin pregnancy is often accompanied by toxaemia. It is simple to lay down laws for diagnosis, but it may be a matter of extreme difficulty to make this diagnosis. In the early months, when the "too large" uterus may suggest other conditions, such as vesicular mole, an X-ray film is a necessity, and will give positive information from about the fourteenth week.

Sometimes twins are not suspected until after the birth of the first child, when the uterus is found to be large and to contain a foetus.

Inspection. The abdomen is larger than normal. This *may* be due to hydramnios, which often accompanies twins, or may be present alone—ascites, tumour, or some such similar condition.

Abdominal palpation. The uterus is so full and stretched that abdominal palpation is often difficult. The most reliable sign given by abdominal palpation is the presence of three large foetal parts : in addition, the palpation of limbs which seem to be present everywhere confirms the diagnosis made. In some cases, more than these three large foetal parts can be made out. Sometimes it is possible to outline the position and presentation of each foetus separately. The small size of the presenting part which may be unfixed will aid in diagnosis. The great difficulty in palpating twins on some occasions is due to the over-stretching of the abdomen and the lie of the babies, one of which may be posterior to the other. If the line from the symphysis to the fundus measured with callipers is more than twelve inches, twins should be suspected. By percussion during pregnancy a fluid thrill is usually felt. This will not be so readily perceived with twins, because they are shut off in separate amniotic cavities.

Foetal hearts. Twins are diagnosed if two foetal hearts of different rates are heard.

Listen for the foetal heart. Put an ink-mark where it is loudest. Then listen over the rest of the uterus. If there is another spot of loud foetal heart-sound, put an ink-mark

over it. Now join the two lines. The sound, which is intense at one of the spots, will gradually decrease to the centre of this line, where it will be absent or almost absent. On auscultation nearer and nearer to the other mark, the sound again gets louder and louder, until the other intense spot is reached. This is the best way of diagnosing two foetal hearts. It is useless to count first one heart and then the other and compare them, for the foetal heart-beat varies quickly with the contraction of the uterus. It is more certain for two observers to count the different beats at the same time.

Vaginal examination. The most reliable sign in this examination is the presence of a small head or of small limbs, having already found the abdomen large on palpation.

Malpresentations are common.

If a prolapsed pulseless cord is felt, and a foetal heart is audible, the diagnosis is certain.

X-ray examination, when possible, will establish the diagnosis in difficult cases.

Course. Unless malpresentations are present, twins are born without any trouble. Uterine inertia from the over-stretched uterus may occur in any stage, causing delay or post-partum haemorrhage. Locking of twins is an extremely rare complication.

The common order for the birth of twins is : (1) the first child, (2) the second child, (3) the united placentae or the placenta of the first, (4) the placenta of the second.

Sometimes the placenta of the first child precedes the birth of the second child.

Treatment. After the first child has been born, palpate the abdomen to ascertain the lie of the second child, correct any malpresentation, then make a vaginal examination and rupture the membranes of the second one as in hydramnios, and apply a tight binder to keep the presenting part down. The membranes should be ruptured a few minutes after the birth of the first child, otherwise great delay in labour may be experienced, for the cervix may close; also in case of great delay the placenta or placentae may separate and the child may die. There is no danger in immediate rupture of the membranes, and post-partum haemorrhage will not occur

unless quick delivery of the second child is done. With the exception of transverse presentation, twin babies, which are usually small, will be born without difficulty: it must be remembered that prolapse of the cord may occur.

If the second child does not descend quickly, press on the fundus with the pains, and so help the uterus.

Remember always to divide the cord between two ligatures. If the funic circulations communicate in a placenta, the second twin may bleed to death through the severed but untied placental end of the funis of the first twin.

Fig. 192.—Locked twins.

If there are two placentae, there is sometimes a short interval between the birth of the two. All precautions must be taken in case post-partum haemorrhage should occur.

Locked twins. Twins may lock in two principal ways and cause obstructed labour. Such locking of twins is fortunately very uncommon and occurs about once in every 9,000 cases of twin pregnancy.

1. When both heads are down, the second head may press into the neck of the first child and prevent its delivery. This is known sometimes as "Presentation of Twins."

Treatment. Anaesthetise the patient and introduce the whole hand into the vagina. Unlock the twins by pushing the head of the second child up into the uterus. If a hand is prolapsed, push it up, for by so doing unlocking may be facilitated. If successful, apply forceps and deliver. In the case of failure to push up the head, try forceps, and as a last resort perforate the first child, for it is more likely to be dead than the second.

2. The first child presents by the breech, but its head is jammed by the second child, lying transversely or longitudinally, and prevented from entering the brim (see Fig. 192).

Treatment. The patient being deeply anaesthetised, with the whole hand try to free the head of the first child

and pull it out. If this fails, the first child cannot be delivered alive. Perforate or decapitate it. Then deliver the second child and finally the head of the first child. These operations are exceedingly difficult. Perforation of the lower head is an easier method of delivery, but has the great disadvantage of destroying a living child.

Foetus papyraceus. This is seldom if ever diagnosed until after the birth of one child. It is due to the death

Fig. 193.—Locked twins.

during some time in pregnancy of one child. The other continues to develop. The dead child gets pressed nearly out of existence between the uterine wall and live child, and assumes a parchment-like appearance, to which the name foetus papyraceus has been applied.

There is nothing special in the treatment of the case different from that of twin pregnancy.

Superfoetation or Superfecundation. In the Rotunda we have had what appeared to be undoubted cases of this anomaly.

There are cases on record, and it seems possible that it

may occur before the union of the decidua vera and capsularis, which happens at the end of the third month.

We have had babies differing by over 2 lbs. weight: others have reported the birth of a small black and a large white baby at one birth.

TRIPLETS

This occurred once in 6,000 cases, and is due to the fertilisation of three ova, or from uniovular twins and a single foetus. Generally the babies are non-viable, but sometimes they are strong and healthy. Our last patient had three babies of weights $4\frac{1}{2}$, 6, and 6 lbs. 2 oz.: they all left the hospital in perfect health.

The conduction of a case of triplets is on the same lines as twins.

We have never seen more than three babies born at one birth, although there are records of the delivery of six dead children.

CHAPTER XVIII

LABOUR: ABNORMALITIES OF THE SOFT PARTS

LABOUR may be delayed by various abnormalities in the soft parts. If these do not always cause dystocia, they may cause trouble in later stages of labour

The Vulva.

Oedema (see Fig. 193). This abnormality in labour may require most careful treatment: it is usually associated with toxaemia, but may be independent.

When discovered at the beginning of labour, cold applications such as lead lotion should be applied: if, however, it is thought that the oedema will not have disappeared by the time labour is finished, the vulva should be punctured with multiple needle punctures, and a sterile pad applied. It is necessary to avoid leaving a large cushion-like vulva to be torn by the baby, for ulcerated masses will form, from which pyaemia may result.

Tumours are seldom encountered: if they interfere with labour they should be removed.

Haematoma may arise from trauma and should be treated on ordinary surgical principles. It occasionally arises during labour and prevents the birth of the presenting part. A haematoma may form after labour from a puncture wound with a needle in stitching the perineum: in either case, it will probably be necessary to turn out the clots, and either pack the cavity or tie the bleeding point.

Imperforate hymen is occasionally seen at labour: when present it should be broken down digitally.

The Vagina.

Atresia and growths. The former is seldom seen, but may occur as a congenital or acquired condition. It is treated by dilatation except in a very extreme degree, when Caesarean section may be necessary.

A woman with benign or malignant tumours is unlikely to become pregnant: if she does, and the growth is small, the baby will be born past it: if large, the growth must be removed except in extreme instances, when the baby must be delivered by Caesarean section.

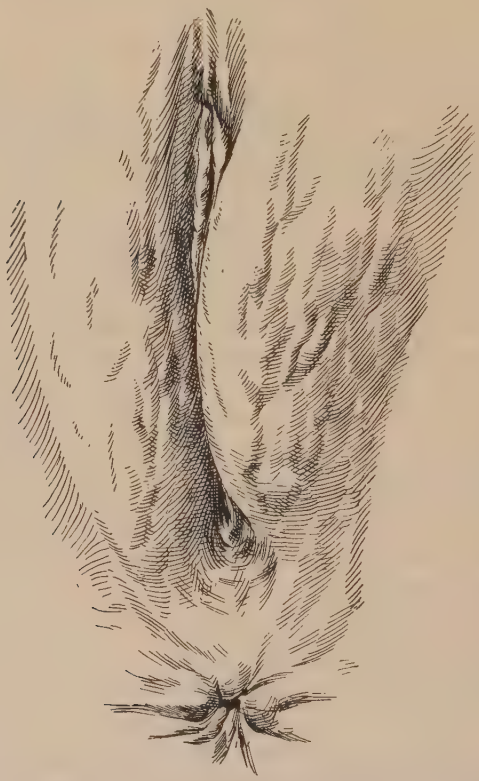


Fig. 194.—Oedema of the vulva. (From author's *Handbook of Gynaecology.*)

The Uterus.

The Cervix.

Rigid os. On rare occasions the os dilates with extreme slowness, or perhaps never dilates fully.

The reasons for this are—

1. Early rupture of the membranes—the dilating power of the membranes is lost.

2. Scarring, or other pathological defect of the cervix.

3. Probably in many of these cases the os is congenitally

defective, so that even though stretched to its utmost capacity it cannot permit the passage of the head without tearing. It was formerly held that rigidity of the os was due to spasm of the circular muscular fibres, but this view is not now generally accepted, and cannot be true.

Course. This condition results in tedious labour. Several days may elapse and yet the os scarcely gets any bigger.

A sharp distinction must here be drawn between the os and the cervix. Pressure on the cervix always succeeds in making it expand by growth, but the os in a primigravida is surrounded by fibrous and elastic tissue and is hard to expand. These fibres will yield to the force of strong contractions, and rigid os is almost never seen, save in the irritable neurasthenic patient, who shrinks from pain and exhausts the power of the uterus by explosions of fretful irritability. Slow dilatation is seen in women who have experienced great menstrual pain, and sometimes occurs when operative measures have previously been undertaken for the repair of a lacerated cervix. Generally speaking, however, plastic operations on the cervix when properly performed do not affect the course of labour.

Treatment.

The non-dilating os. It is necessary to determine if there is any cause such as contracted pelvis. If not, patience is the chief treatment. Make the patient sleep by giving chloral and opium. Chloral especially seems to favour the dilatation of the os; copious hot vaginal douches act in the same way. These have the effect of softening and loosening the fibrous tissues, and allaying the acute pain of cervical dilatation, which sometimes inhibits proper uterine action.

The os that does not dilate because the membranes have ruptured before dilatation. In nearly all cases the presenting part of the foetus comes down and dilates the os. A large caput forms. The first stage is often tedious, and may last some days. In spite of rupture of the membranes, sufficient liquor amnii remains in the uterus to prevent disastrous consequences, provided the lower uterine segment closely fits the presenting part.

When the mother's pulse rate and temperature rise above 100, or the foetal heart indicates distress, it is sometimes necessary to hasten labour. It must be pointed out, however, that *this is scarcely ever necessary :* when it is, the best method is—(1) to introduce a Champetier de Ribes bag into the cervix (see p. 564).

(2) Harris has suggested the manual method in which the whole hand is placed in the vagina, and the thumb and index finger are put through the cervix and are used in a manner similar in direction to that resulting from snapping the finger. This opens the os, and the second, third, and finally the little finger are successively inserted, until by strong flexion the os is forced open. The thumb is used to cause pressure in the opposite direction. We have never had occasion to use this mode of treatment.

(3) By Frommer's dilator. There is no doubt this tears the cervix, and does not dilate : we do not recommend it.

(4) The os can be opened by multiple incisions (Duhrssen's method). We discontinued this operation many years ago, for prolapse follows it.

Of these methods douching and chloral are the best. The hydrostatic bag may occasionally be indicated, but the other methods are not recommended by us.

Fibroids in the cervix. In labour, cervical fibroids may cause marked dystocia : the larger the fibroid the greater will be the dystocia. The tumour is easily recognisable and will prevent descent of the head. If it is obvious that the head will not come down, and the tumour cannot be pushed past it, Caesarean section alone, or followed by hysterectomy, is indicated. Myomectomy for cervical fibroid in labour is a dangerous operation because of the severe haemorrhage which sometimes follows it.

Cancer of the cervix. Labour complicated by carcinoma of the cervix is a rare and fatal condition. It is treated by Caesarean section followed by Wertheim's hysterectomy.

The Body of the Uterus.

Physometra. This is an extremely rare condition, and occurs in delayed labour where the membranes have ruptured for some time, and where air has been admitted to the

uterine cavity. The contents of the uterus (membranes, liquor amnii, and perhaps the foetus) undergo decomposition, the uterus dilates, and becomes filled with putrid gas, giving a tympanitic note on percussion. There is a stinking vaginal discharge and the baby is often dead. The temperature and pulse are raised, vomiting occurs, and a fatal toxaemia may result.

Treatment. The uterus must be emptied at once, if possible per vaginam, but if the os is closed and has not been taken up, and the baby is alive, the lower segment Caesarean section seems to be the most favourable course to adopt. Theoretically, hysterectomy would seem to give the woman a better chance of recovery, but this is not so in practice; in fact toxic patients seldom survive the latter operation.

Fibroids. In the body of the uterus these tumours may cause inertia during labour, and it is treated successfully without any operation: in fact unless the tumours are in the cervix as already described, there will be no dystocia. In the puerperium, fibroids may slough or undergo red degeneration. Should either of these occur hysterectomy will probably be indicated.

Cancer. This is such a rare complication of labour that it need only be mentioned.

Uterine inertia. This is a condition where the uterus fails to act with its normal power and regularity. There are two varieties, namely, Primary and Secondary. Primary inertia, as described formerly, was a process where the contractions were ineffective. Secondary inertia, as described, was due to exhaustion of the muscle. We have reconsidered our views on this troublesome subject, and have formulated them below.

There are certain definite factors which may account for uterine inertia:

(1) Weakness of the nerve impulses to the muscle.
(2) Inherent weakness of the muscle itself.
(3) Mechanical interference with contraction.

Of these, the first two will fall under our definition of Primary inertia. The first is easily the most important;

Crile holds that nerve centres should be considered in the nature of storage batteries, and the strength of a muscle is very largely determined by the strength of the nerve stimulus. If the nerve storage is interfered with, or dissipated, as it will be in neurotic patients, by pain, fear of pain, or exaggerated complaints in respect of pain, the energy reserved for the uterus will be greatly diminished.

Secondly, inherent weakness on the part of the muscle will only occur when the muscle has been unduly stretched by such conditions as hydramnios or myomata, or has had to overcome such resistance as contraction of the pelvis or some form of disproportion.

There are various puzzling problems with respect to inertia which have not been, and are unlikely to be, solved, until the cause of the onset of labour is discovered: as, for instance, the variable influence exerted by a dead foetus on the contracting uterus. As a rule the dead foetus sooner or later stimulates the uterus to expulsive action, but in rare instances the contrary takes place. The foetus may be retained in utero for long periods, or, again, its death may coincide with the cessation of labour; a stoppage which may be extremely difficult to cope with even with the assistance of strong oxytocics.

By the terms (1) Primary and (2) Secondary, in all branches of medicine, we mean a condition arising from (1) something permanently wrong in the organ itself, (2) something arising because of some extraneous condition, and we feel that the time has come to drop the old classification of inertia, by which was meant inertia early or late in labour, and to come down to practical facts. The great difficulty in dealing with this subject lies in the endeavour to make the diagnosis between primary and secondary inertia, in other words, to determine whether there is anything outside the uterus making it inert. We hope to make this clear in the succeeding paragraphs. So long as we do not know definitely the cause of the start of labour, we must theorise to some extent. In making a new classification, we shall divide the condition into Primary and Secondary, and subdivide these into early and late, depending on whether the condition is present in the first twenty-four hours or afterwards.

Primary uterine inertia. By this is meant weakness of the muscle due to something primarily wrong in the uterus itself, *i.e.* inertia due to some weak nerve impulse, weak muscle, or hormonic cause. The first cannot definitely described. The second is found in the large slack uterus of multiparity, in the uterus diseased from syphilis, heart or kidney disease, or some similar cause.

Symptoms. Labour usually starts in the ordinary way. After a varying period the pains get sluggish until they pass away altogether and complete inertia sets in: this may occur in a primigravida or a multipara: it may occur in the first twenty-four hours or afterwards, and the first effort of the doctor is to make out definitely that the condition is truly one of *primary* inertia, and that it is not *secondary* to something such as full bladder, contracted pelvis, or some such similar cause.

Having excluded these, the case may be proceeded with. Labour may not advance for hours or even days: occasionally even the os which was open may close again. More often, however, the pains are feeble but cause severe discomfort, the patient cries out for chloroform, the nurse may send for the doctor to give it. He finds on arrival that there are scarcely any contractions of the uterus, that the retraction level is down near the symphysis, that the temperature, pulse, and foetal heart rates are normal. He should not make, and there is *no necessity to make, a vaginal examination.* If he wants further information, a rectal examination may be done. To do anything drastic at this stage will mean nothing but harm. Chloroform will increase the inertia. To try to force open the cervix by any means, and deliver, will probably mean a dead baby and a badly traumatised or dead mother, while to help the woman by rest and good advice will probably end in success. The prognosis will depend to a large extent on the length of time since rupture of the membranes, for as long as they are intact, the prognosis is excellent.

Treatment of primary inertia, early and late. The first point in this is to know definitely that there are no secondary conditions present. Having excluded these, the main factors are (1) to get the patient to sleep at night,

(2) to encourage the pains in the daytime, (3) to watch the progress of labour, especially noting the foetal heart when the membranes have ruptured, (4) to interfere at the right time but not too late.

It is easy to get the patient to sleep if the case does not last very long, but if it is a matter of days, morphine must be conserved. First take a case which lasts one day. Morphine gr. ¼ is given, she wakes in the morning refreshed, and is given something to stimulate the uterus. If the inertia lasts longer, it is well to try alternative treatments. The effect of morphine may wear off, and while it may be given for two nights, it is well to try something like the three fifteens (pot. brom. grs. 15, chloral hydrate grs. 15, tincture of opium ♏ xv) of most hospital formularies on the next occasion. Such other analgesics as omnopon, chloral hydrate ʒij by the rectum, veronal, veramon, may all be useful. *It is very important that the patient should sleep well.*

In the daytime she should be encouraged, she should be told that everything is well, that interference at this stage will do nothing but harm, and that help will be given when it is safe. The doctor should not be present too often, for he will be expected to do something, and his presence often increases the inertia.

Uterine stimulants should be administered during the daytime. We have found quinine hydrobromide in doses of 10 grains in solution of extreme use. Pituitary extract in repeated doses of ¼ c.c. is safe : it is given every half-hour until 1 c.c. has been given—but it must not be used in cases of disproportion.

It seems wise at this stage to give our ideas on the use of pituitary extract. As already stated, it is safe during the first stage, where there is no disproportion. In the second stage, however, with one powerful exception, we do not use it. The exception is when the head is actually *on* the perineum : we then give ¼ c.c., sometimes repeated. If this is given, the foetal heart rate must be listened to attentively, and delivery with forceps accomplished if necessary. We also give it to save the application of forceps where such a condition as gonococcal vaginitis is present.

With the exceptions just mentioned, during the second stage the use of pituitrin is not advocated, and there are many arguments of a practical and theoretical nature which serve to contra-indicate its employment: viz. (1) Pituitrin in the second stage tends to diminish the placental site and thus reduce the amount of oxygen going to the foetus. (2) The foetal head is likely to undergo a more severe degree of moulding, and therefore the brain and vessels are subjected to more stress (in those cases in which there is delay in the second stage) than would be the case if forceps had been employed. With reference to this subject Holland describes how out of 167 cases (fresh foetuses) the tentorium cerebelli was torn in 81 (or 48 per cent.), in association with which the falx cerebri was torn in five cases, and with subdural haemorrhage in all except six. Most of these cases were either contracted pelves, or delivery was effected by means of forceps, or by breech; though a few appear to have occurred in the course of a perfectly normal labour. Whenever the shape of the foetal head is altered by moulding, these above-mentioned dura mater septa must be affected to a greater or lesser extent. These septa perform the same function in relation to the cranial bones as do stays to the mast of a ship, all movement, or bending, of the bones being resisted by their tension. If the bones are bent or moved too far in any direction, tearing of the septa results. If the stays of a mast snap, greater play is allowed to the mast, with the result that it gets broken; similarly tears of the septa allow great movement to, and bending of the cranial bones, which is liable to be accompanied by fatal injury to the cranial contents. According to this idea the septa have a purpose in protecting the head against becoming excessively altered in shape. Moderate moulding is very beneficial, and if it did not occur, many children would not be born alive. Hence excessive moulding is always to be regarded as dangerous to the life of the foetus. Certain of the blood-vessels become over-stretched, and rupture, death following from cerebral haemorrhage. Pituitrin when given in the second stage is likely to induce this condition: we have known cases of foetal death that could not be attributed to any other cause. As a further reason, on the part of the

mother, it may be urged that tearing of the soft parts may be increased by the precipitate labour following the administration of this drug.

Another argument against its use in the second stage is that retained membranes may follow. In the third stage it has been advocated before the birth of the placenta: it has been suggested that it lessens haemorrhage and shortens that stage. We have tried it and have met several cases of retained placenta which we feel we had to attribute to its use: we have therefore given it up during this stage of labour. We believe it is effective in causing contraction of the uterus after the placenta is born, but it has not been found to be very effective in the puerperium. To sum up our views on the subject. Pituitrin is of great assistance in the first stage of labour, when it must be used with caution. It is also effective after the third stage is finished, in causing contractions of the uterus.

Latterly we have had some success with a proprietary preparation called thymophysin, but it is a strong and dangerous drug and must be used with extreme caution. We give 0·5 c.c., and repeat it when necessary. Each ampoule contains "the quantity of albumenless thymus extract corresponding to 5 grammes of the fresh gland and such a quantity of hypophysis extract that both extracts correspond at least to 15–20 international units per ampoule." The measure of success achieved with this drug leads us to believe in the hormonic origin of some cases of inertia. Local treatment will be of assistance. Hot enemas of soap and water stimulate the cervical ganglia and aid in restarting the labour. Hot vaginal douches help in the same way: when given, these should be kept up for about fifteen minutes: they give immense relief to the patient, and may be repeated in three or four hours. A tight binder, combined with the pad as illustrated (see p. 467), keeps the presenting part down in the pelvis and stimulates the cervical ganglia.

This, then, is the line of treatment to adopt in these troublesome cases, but the baby is not yet born, and the question as to delivery now arises.

Our first warning is against delivery before all conditions

are fulfilled: delivery before the cervix is fully open is practically never necessary.

So long as the membranes are unruptured there is no danger for either mother or child, and palliative measures may be proceeded with.

Is it ever justifiable to effect delivery in cases of primary inertia? The answer is undoubtedly in the affirmative. Even although the labour may be prolonged, the cervix will open fully and the head will be fixed in the brim by its greatest available diameter: then delivery should be effected, by forceps in the case of head presentation, by traction in the case of breech presentation. There is little or no danger of post-partum haemorrhage if patience is exercised and delivery not hurried.

Secondary uterine inertia. As we divided primary, so we divide secondary inertia into early and late. In the former, pains never start properly; in the latter, inertia commences after twenty-four hours, and investigation will show some definite cause.

When it occurs early, no symptoms of dystocia have arisen: when late, the signs of obstructed labour are present, and woman and child are in danger.

The causes are numerous and may be found in any of the faults in the powers, the passage and the passenger (see p. 414). Full bladder and rectum, contracted pelvis, tumours, are the commonest causes.

To take some typical cases.

Early secondary inertia. The patient falls into labour, and soon the pains cease. On examination it is found that the bladder is full: when this is emptied, labour progresses. A more usual cause is disproportion, the presenting part cannot fit into the brim, and labour pains cease. If the disproportion is great, the diagnosis of the case is easy: if, however, it is slight, the case is more difficult, but symptoms will not arise until later in labour.

The treatment of all cases is to discover the cause and treat it.

Late secondary inertia is nearly always due to disproportion of some kind, although the minor causes such as full bladder must be borne in mind.

A typical case is where the patient falls into labour, and after twenty-four hours has advanced to a certain point: she then falls right out of labour, and the uterus gets into a state of inertia. A close examination must be made. It is then found that the temperature and pulse have risen: the foetal heart rate is variable: *i.e.* it sometimes goes below 120 or above 160: the retraction level is near the umbilicus: the membranes have ruptured for some time. A rectal examination reveals, and a vaginal examination if necessary confirms, the fact that the os is still only half dilated, *i.e.* retraction has done all possible: it is working against obstruction, and the cervix will dilate no further. The case must then be treated as for contracted pelvis. It is more than likely that the lower segment Caesarean operation will be necessary (see p. 602). If, however, the cervix is fully dilated, it will probably be possible to deliver the baby by forceps, for the obstruction is so slight that this will be a safe procedure.

The prognosis depends very largely on the time that has elapsed since the membranes have ruptured. We regard thirty-six hours as a danger time, but once they have ruptured, close watch must be kept on the foetal heart rate, and the temperature and pulse of the mother.

To sum up the situation. Diagnose whether the inertia is primary or due to a secondary cause. If the former, all will be well, provided efforts are not made to deliver too soon. If the latter, the cause must be ascertained and appropriate treatment given, for it is usually accompanied in this type by signs of obstructed labour, with high retraction ring, pains sometimes almost tetanic in nature, with tender abdomen, mouth dry and an anxious and fretful patient.

The table opposite gives, in short, our views on uterine inertia.

DELAYS IN LABOUR

It is convenient here to speak of the delays in labour and their causes. They may be discussed under the three P's. They are dealt with in their appropriate places in this book.

Uterine Inertia

	Primary.		Secondary.	
	Early (first 24 hrs.).	Late (second 24 hrs.).	Early (first 24 hrs.).	Late (second 24 hrs.).
Cause.	Weak nerve impulse. Weak muscle, *e.g.* multiparous uterus.	Tired muscle from long labour. Early rupture of membranes.	Any fault in the soft parts, *e.g.* full bladder, and rectum, tumours. Bony disproportion, tumour of the uterus or excessive size of baby.	Same.
Symptoms and Signs.	No pains.	Inertia starts after 24 hours.	Probably mobile presenting part, accompanied by absence of pains.	Symptoms of prolonged labour, with probably those of threatened rupture. High retraction ring. Membranes long ruptured. T. and P. raised, etc. Cervix may or may not be dilated. A careful diagnosis must be made from primary.
Treatment.	Leave alone.	Get patient to sleep at night. Uterine stimulants by day. Vaginal douches. Enemas. Encouragement. Delivery when conditions fulfilled, and not until then.	Treat cause.	Treat cause.
Dangers.	None, if no unnecessary interference.	None to either so long as membranes are unruptured. If interfered with, early PPH. Trauma of soft parts, etc. Danger to baby.	Sepsis; therefore do not make vaginal examinations unless absolutely necessary.	Ditto. The baby will be lost unless proper steps for delivery are taken in time.

The Powers.	*The Passage.*	*The Passenger.*
Lax abdominal wall.	Vulva.	Malpresentation.
Pendulous belly.	Oedema.	Twins.
Slack uterus.	Tumours.	Hydramnios.
Uterine tumour, *e.g.* Fibroids.	Haematoma.	Large foetus.
Physometra.	Imperforate hymen.	Over-carrying.
Inertia.	Vagina.	Monsters.
Early rupture of membranes.	Atresia.	Hydrocephalus.
	Tumours.	
	Uterus.	
	Rigid os.	
	Operations on cervix.	
	Congenital defect.	
	Fibroids of cervix.	
	Cancer.	
	Bones.	
	Contracted pelvis.	
	Tumour of pelvis.	

PRECIPITATE LABOUR

Either true precipitate labour may occur, or the child may be born unexpectedly, because the mother is insensitive to the labour pains. Another reason is the existence of a pelvis that is enlarged in all its diameters, the so-called justo-major pelvis. This occurs usually in giantesses, but sometimes in women of otherwise normal proportions.

Dangers. The dangers are chiefly to the child. If the mother is standing at the time, the child may fall on the floor and be killed, or it may die of haemorrhage from the ruptured cord.

The chief danger to the mother of true precipitate labour is that her perineum may get badly torn, although this is exceptional, as the accident most frequently occurs in multiparae. Some writers say that inversion of the uterus and post-partum haemorrhage occur. But inversion does not occur unless the uterus is relaxed, and post-partum haemorrhage does not occur in a uterus that contracts and retracts strongly; therefore, being without figures to prove these statements, we are sceptical of them.

Treatment. The patient is usually not seen until labour is over. If she has a history of previous precipitate labour, keep her in bed, and if the pains are very violent, control them with chloroform.

OVER-ACTION OF THE UTERINE MUSCLE

This is the reverse of inertia, and may show itself in three ways:

(1) Retraction ring.
(2) Contraction ring.
(3) Tetany—or sustained tonic contractions.

In considering these three causes of delay in labour, a careful diagnosis must be made, for there is a difference in cause and treatment.

(1) **Retraction ring.** The formation of the lower uterine segment has already been explained (p. 91). Retraction ring dystocia is due to an excess of physiological action. As the upper segment of the uterus retracts and gets shorter, the lower segment gets longer, and the junction between the two becomes higher. This is due to some obstruction, and is accompanied in a marked case by the symptoms and signs of threatened rupture of the uterus.

The main features are :—The retraction ring, which is a groove between the segments, becomes higher. The lower segment gets thin and shows a marked contrast to the thick upper segment. The *presenting part is felt by vagina*, firmly wedged in the pelvis. In other words, in an effort to overcome obstruction the junction of the two segments becomes high and rupture will occur if delivery is not terminated.

The treatment is delivery without much manipulation, *i.e.* forceps on the head, or traction on the breech, but no version, for fear of rupturing the uterus. Caesarean section may be necessary because of disproportion.

(2) **Contraction ring.** This may occur in any stage of labour. In the third it is dealt with in the chapter on abnormalities of this stage, when it is known as hour-glass contraction of the uterus. In the first two stages it may be due to—

(*a*) Drugs. Ergot and pituitary extract are the commonest of these. Ergot should never be given until the third stage is completed, while the indications for the administration of pituitary extract are given on p. 408.

(*b*) Manipulations. Ineffective attempts at delivery either by version or forceps.

(*c*) Premature rupture of the membranes.

Symptoms and signs. In spite of good pains, there is no advance in labour. The temperature and pulse are normal, the patient does not appear ill. On examination

of the abdomen, a *thickening* is found at the junction of the segments, there is no thinning below. The uterus relaxes between the pains, and is not tender. Some of the presenting part may be above the ring. While this is the case occasionally, the presenting part may be below the ring which encircles the neck of the child and can only be felt when the fingers are passed beyond the head to ascertain the reason for non-descent of the foetus (see Fig. 195). It is not absolutely diagnosed until a vaginal examination has been

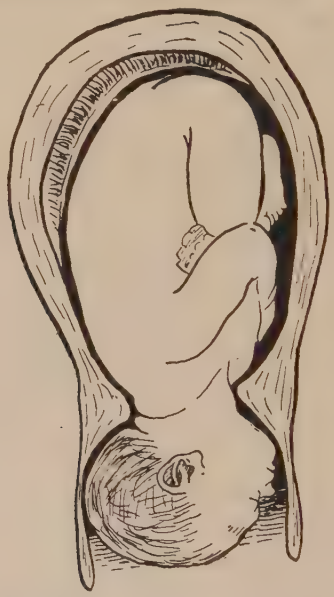


Fig. 195.—Contraction ring dystocia.

made, when a thick annular elevation is found. Occasionally this abnormality is not discovered until, all conditions for forceps being fulfilled, attempts to deliver fail and a ring is then apparent.

Treatment. This must be considered with care. The best thing to do is to give the patient morphine, gr. $\frac{1}{4}$, or some whiffs of chloroform, when the contraction may disappear. Adrenaline chloride ♏ x injected intramuscularly has been successful, but it is dangerous if used in combination with chloroform. Atropine sulphate gr. $\frac{1}{100}$ causes relaxation of involuntary muscle and may be tried. If this is unsuccessful, digital dilatation carefully performed

may succeed: it is said to be fraught with danger, but on the rare occasions we have practised it no harm has resulted. If the breech is presenting, gradual traction may remove the constriction. When the patient is under chloroform the question of immediate delivery arises. Sometimes it is safer to leave the patient alone: the ring may, however, recur. In our experience it is safe in most cases to deliver, and a carefully performed version, followed by extraction when the cervix is fully dilated (traction being very slow and gradual), is good treatment. When, however, the constriction is unyielding it is extremely dangerous to persist with version, as rupture may occur. Caesarean section has been suggested as a treatment; it is rarely necessary and must be reserved for those cases where the ring persists and where manipulative measures such as version will be obviously disastrous. The lower segment operation is then the choice.

(3) **Tetany of the uterus.** This is an exaggeration of the last, in which the whole uterus is thrown into tonic contraction. It is caused by over-contraction and retraction, and occurs as a rule only in cases where there has been a great deal of obstruction and manipulation. The whole uterus is in a tetanic condition, and symptoms of threatened rupture may be present. When efforts are made to deliver, it is found that the inside of the uterus is thrown into irregular contractions.

The **treatment** consists of delivery as recommended in cases of threatened rupture of the uterus.

It is most important to make a differential diagnosis between *contraction and retraction ring dystocia*, and the following columns give a clear idea of this difference. They sum up to a large extent the ideas of Clifford White, but are slightly modified.

Contraction Ring.	*Retraction Ring.*
Cause. Drugs. Premature rupture of membranes. Manipulations.	Obstructed labour.
Thickening marked at junction of segment, localised.	In upper segment no localised thickening.
Thinning. None.	Marked.
Presenting part varies.	Never altogether above ring.
Uterus relaxed between pains. Not tender.	Retracted. Tender.

Contraction Ring.	*Retraction Ring.*
Stage of labour. Any stage.	Late in obstructed labour.
Site. Stationary: there may be one or more.	Moves higher with labour.
Condition of patient varies.	Requires immediate delivery.
P.V. Ring felt encircling *e.g.* the neck.	Not felt P.V.
Treatment. (*a*) Morphine. (*b*) Chloroform, adrenaline, atropine. (*c*) Digital dilatation. (*d*) Version in head presentation. (*e*) Pressure by breech after gentle traction. (*f*) Caesarean section.	Delivery without undue manipulation.

THREATENED RUPTURE AND RUPTURE OF THE UTERUS

There are three varieties of rupture of the uterus: (1) Rupture preceded by warning signs and symptoms: this is shown by statistics to be the most common; (2) Quiet rupture, not preceded by warning signs and symptoms; (3) Rupture following manipulations. We deal separately with each.

1. Rupture preceded by the signs known as those of threatening rupture.

Causes. Anything which leads to obstructed labour may lead to rupture of the uterus. The chief causes are: (1) contracted pelvis; (2) malposition of the child, especially cross-births; (3) hydrocephalus; (4) obstruction by tumours; (5) the ill-advised use of such drugs as pituitary extract. Pendulous abdomen (see Fig. 196) is a cause of rupture of the uterus, which may or may not be preceded by warning signs, but this is an uncommon cause. The direction of the push of the uterus is backwards against the sacral promontory. The uterine wall, between the bony head and sacrum, gets pinched and crushed, and eventually is worn through or gives way from being too tightly stretched over the head.

Rupture of the uterus rarely occurs before rupture of the membranes. Indeed, before rupture of the membranes it could occur only in women becoming pregnant after previous uterine rupture or Caesarean section.

Signs and Symptoms of Threatening Rupture, with Diagnosis.

Tonic contraction of the uterus. The uterine muscle, stimulated by the difficulty it encounters, puts forth greater and greater efforts. The pains last longer, are stronger and more frequent, but are not expulsive in character. Relaxation between the pains is progressively less complete, and

FIG. 196.—Diagram to show how pendulous abdomen tends to produce rupture of the uterus.

eventually the contractions of the uterine muscle become continuous or tonic. The uterus moulds itself to the child, but so tense is the muscle that the foetal parts cannot be felt. At the most, one can conjecture the position of the child by the cast formed by the moulding uterus. The hard uterus is often *very tender*.

Bandl's Ring. We have already dealt with the different forms of ring dystocia. Bandl's ring may be described as the lower border of the retracting muscle of the upper

muscular segment of the uterus, separating it from the stretched lower uterine segment. As contractions and retractions occur, gradually drawing the lower segment upwards and pushing the presenting part downwards, the level of the segments becomes higher and higher: if there is compensating descent, physiological action occurs: if, however, there is obstruction, the lower segment becomes thinner and thinner until it becomes as thin as paper. The higher this ring ascends, the more is the danger, until the thinning is so acute that rupture occurs.

A careful diagnosis of this ring must be made from a full bladder and from a groove formed by some foetal part. The ring as a danger sign will always be accompanied by other signs of danger.

Fig. 197.—Large caput of difficult labour.

Round ligaments. In normal labour the round ligaments can be felt, especially the left, owing to the normal twist of the uterus bringing the left side more to the front than the right. When rupture of the uterus is threatening, the muscle of the round ligaments shares in the tonic contraction of the uterine muscle. The round ligaments stand out prominently, and are hard and taut.

Vaginal signs. On making a vaginal examination, the vagina is found unnaturally hot and dry. Its walls are swollen, and the labia are oedematous. The presenting part is probably high up, and is obscured by a large caput; the upper part of the vagina is pulled up, stretched and spacious—the ballooned vagina. With a pain there is no advance of the presenting part. There may be a little bleeding, showing that some uterine fibres have given way already. The border of the cervix may be thickened, and the os may become narrowed from blood effused into it.

Effect on the mother. The woman herself is profoundly affected by the uncontrollable violence of the contractions of her uterus. She experiences the agonising pain well known to every one as cramp. The uterus is very tender.

The patient shrieks with pain if abdominal palpation is at all forcible. She is full of anxiety, and acutely conscious of the terrible crisis through which she is passing. Her eyes are haunted by the fear of impending death, her face is drawn and pinched with pain and exhaustion, her lips and mouth are dry, she has sordes on her gums. She moans continuously, her breath is quick and panting, her rapid pulse grows more rapid and more feeble, sometimes uncountable, and her temperature continues to rise. Only when rupture occurs does relief come to her, and then it is the relief of shock.

Effect on the child. The retraction and contraction of the uterus so interfere with the placental circulation that the child shows signs of asphyxia. Its movements are tumultuous, solid meconium comes away, although the head presents, and its heart is under 120.

Treatment of threatened rupture of the uterus.

Immediate delivery is the one and only treatment for both mother and child.

Anaesthetise the patient.

(1) If the head presents and the foetal heart is audible, if conditions are fulfilled for delivery, apply forceps.

(2) If the child is dead, do craniotomy and extract.

(3) If the breech presents, treat as described under impacted breech.

(4) If transverse, and the symptoms of threatened rupture are really present, decapitation must be done.

(5) If the pelvis is too small to allow even a perforated eviscerated child to pass, the low segment Caesarean section is the operation of choice.

Rupture following the Signs of Threatened Rupture.

Where the rupture occurs. In most cases the lower uterine segment is tightly stretched over the child's head and tears transversely where it is most stretched and thinned. Sometimes it is most stretched over the child's shoulder. When the tear has started, it may extend in any direction up to the fundus and down into the vagina.

The important practical fact about the tear is whether the peritoneum has been torn or not. Rupture without tear of the peritoneum is called incomplete, and is less dangerous. Rupture with tear of the peritoneum is called complete.

Effect on the mother. Shock may be fatal, or the patient may die of haemorrhage. The shock may be less severe and subsequent peritonitis may be the cause of death. She may recover. The change of aspect in the mother is striking. She may cry out and say that something has given way. She then passes from a condition of acute tension to one of shock. The hot, congested face of exertion becomes pale and cold. A clammy sweat appears on the forehead and cheeks. Her breathing, no longer panting, is now soft, shallow, and almost inaudible, except for an occasional moan. She no longer cries out with pain, but lies back prostrated and relaxed. Her pulse is feeble and rapid, particularly if she has lost blood, although in some cases it may be feeble and slow. Her temperature may be sub-normal.

The change is not always so pronounced as this. The woman undergoes shock, but she is not so profoundly affected. Still the change is always both striking and sudden.

Diagnosis. The change of aspect in the woman will suggest the probability of rupture. Examine by *abdominal palpation*. The physical signs differ with complete or incomplete rupture.

Complete. Some part of the foetus will escape through the rent. Sometimes the whole foetus is free in the peritoneal cavity. In either case the foetal parts are felt with surprising ease, which is so very different from the previous condition that there can be no doubt of the complication present.

Incomplete. The uterus will be found tender to the touch and bulging at one part. In both complete and incomplete rupture the hard body of the uterus is felt separate from the foetus or the swelling. It is so hard that it has been mistaken for the foetal head.

By vaginal examination the diagnosis can be verified.

The previously felt presenting part has now receded. This is a certain sign, and is present in incomplete as well as in complete tears. There is haemorrhage of varying extent. Sometimes it is profuse, sometimes mainly internal and shown by increasing collapse, although occasionally the amount of haemorrhage is surprisingly small.

2. **Quiet rupture.** This is the form of rupture that we have most commonly seen in Ireland. It occurs in multiparae who in previous labours have had deep lacerations of the cervix. The rupture is an extension from the old tear and scar tissue, and nearly always involves the vaginal vault. So quiet is the rupture that on several occasions we have been called to patients suffering from this complication, although neither doctor nor nurse in attendance had any suspicion of the grave condition present.

The diagnosis is readily made by abdominal palpation and vaginal examination. When the rupture occurs, the patient experiences distinct relief and cessation of labour pains, with subsequent development of shock.

3. **Rupture as the result of manipulations.** (1) Attempts to turn, when the uterus is already approaching tonic contraction; (2) vigorous pulling, or pushing from the abdomen, of the foetus through an undilated os; (3) putting too many fingers through the os in a case of placenta praevia; (4) removal of an adherent placenta; (5) the injection of pituitary extract. We have seen several cases of rupture of this kind. It may occur when a large dose is given before the os is fully open. We have had patients brought to the hospital moribund when pituitrin 1 c.c. was given to a primigravida where the cervix was not fully open. The rules for the injection of this drug must be carefully followed (see p. 408).

The signs and diagnosis have already been given.

Treatment of Ruptured Uterus.

The patient is usually so shocked that an anaesthetic is unnecessary: in some cases she is quite conscious, and a little open ether is indicated.

Generally speaking, our treatment consists of "Plugging the Rent."

Rupture having been diagnosed, the child is delivered by the vagina. Either forceps are applied, or the child is delivered by traction on both feet. There is some slight risk in extending the tear, but the case is full of risks, and retraction is so rapid after delivery that the tear will not be so extensive as it might appear. After the birth of the child, remove the placenta. It is an uncanny feeling being among the intestines, and this may occur.

How to plug the rent. The rent is then plugged with iodoform gauze, which is held loosely bunched in the hand, as a housemaid holds a duster. It is introduced *en masse*, so that it fills the rent firmly and exercises pressure on its lips but does not penetrate to the abdomen to any extent.

Within twenty-four hours the edges of the rupture contract and compress the gauze plug. After this, day by day, the plug should be loosened gradually, drawing out a little at a time to permit further retraction of the tear until the last of the gauze may be removed on the fourth or fifth day.

Plugging serves a threefold purpose: (1) it prevents intestines prolapsing into the vagina; (2) it drains away blood already in the abdomen; (3) it arrests further bleeding.

Treat the shock and collapse in the manner described under accidental haemorrhage.

This treatment, though simple, is followed by better results as a rule than those obtained by laparotomy. It stops the haemorrhage without adding to the shock. We have had much success with it. Fig. 198 illustrates a plug which was extruded from a tear in the uterus in a successful case.

The patient must be observed carefully after plugging: if the haemorrhage has not ceased, there may be a spouting vessel high up. This is very rare, but if it should occur, the abdomen must be opened and one of the undermentioned treatments carried out.

Are there any cases where plugging is not indicated?

(*a*) In the case just cited.

(*b*) If no foetus can be felt by vagina, and it is entirely in the abdominal cavity.

Otherwise, plugging the rent is entirely satisfactory.

The alternative treatments are:

(1) Hysterectomy, with drainage. We regard this as the

FIG. 198.—Plug from ruptured uterus. (Rotunda specimen.)

second best treatment. The abdomen is quickly opened, a subtotal hysterectomy performed, and a tube is placed in Douglas' *cul-de-sac* and brought through the lower angle of the wound. Further drainage can be got by passing a tube into the vagina through the posterior fornix.

(2) Laparotomy, stitching the rent, with drainage. If it is decided to do this (and we do not regard it as good treatment), we certainly advise drainage.

If general peritonitis is present when the case is seen, the abdomen must be drained: the prognosis is extremely bad. The ordinary routine, *e.g.* rectal salines, should be started. Pus should be taken for culture, with the idea of giving vaccines.

Similarly, if peritonitis should occur within a few days of the primary treatment, the abdomen must be opened and drained. This should not be delayed in case of doubt, and the prognosis here is better than when the peritonitis occurs in the first instance.

Antistreptococcus serum 20 c.c. is given as a prophylactic in all cases of rupture of the uterus.

CHAPTER XIX

ABNORMALITIES CONNECTED WITH THE PELVIS, INCLUDING DISPROPORTION AND ABNORMAL PELVES

Growth and Development of the Normal Pelvis.

THE pelvis of the child is different in its general characters and in shape from the pelvis of the adult woman. The promontory of the sacrum does not project, and is relatively higher and further from the symphysis pubis; the sacrum itself is straighter from above downwards, its alae are more slightly developed, the ilio-pectineal lines are not so much curved and meet in an acute angle at the pubes, the rami of the pubic bones are relatively shorter, and the pubic arch is more angular. The pelvic canal is in consequence narrower and more funnel-shaped than in the adult

The development of the pelvis from the foetal to the adult female type is the result of various forces acting on the growing bones.

The body-weight is transmitted down the spinal column to the sacrum. The sacrum is, in consequence, pushed downwards and forwards, and tends to rotate around a transverse axis, bringing the promontory downwards and forwards, and the coccyx and tip of the sacrum backwards. The posterior superior iliac spines become prominent as the sacrum sinks.

The pull of the sacro-iliac ligaments widens out the lateral portions of the innominate bones and increases the curve of the ilio-pectineal lines. This increased curvature also opens out the arch under the pubes. The downward pressure of the trunk is counteracted by the upward pressure transmitted through the femurs, which also tends to increase the curve of the ilio-pectineal lines.

The sacro-sciatic ligaments limit the posterior displace-

ment of the lower part of the sacrum, and thus cause the concavity of the adult sacrum from above downwards.

As they grow, the alae of the sacrum take on the curve of the ilio-pectineal lines and cause concavity of the sacrum from side to side. The lateral masses of the sacrum, the rami of the pubes, and the ischium grow, and increase the width of the pelvic canal, which thus loses its long, funnel-shaped character, and becomes shorter, more curved, and more circular in shape.

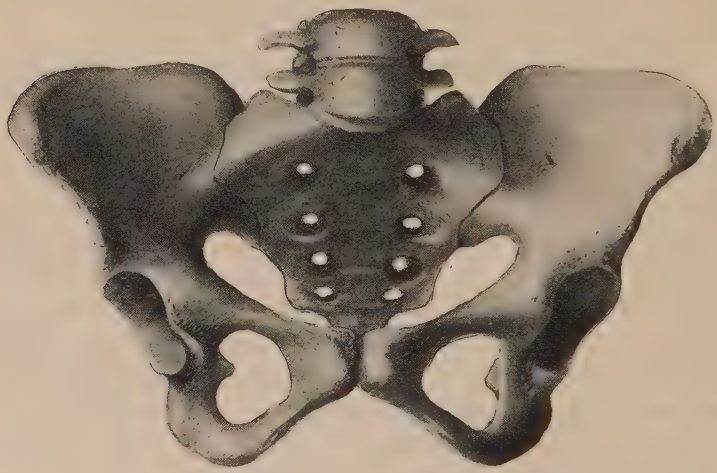


Fig. 199.—Normal pelvis.

Disproportion.

Methods of Diagnosis.

(1) **Antenatal.** The diagnosis of disproportion, by which is meant in most cases contraction of the pelvis, should, if possible, be made some time in the *antenatal* period. In fact antenatal diagnosis is the keynote of success in the treatment of these troublesome cases. If the patient be seen in the early months, attention may be drawn to the likelihood of trouble in the confinement, by (1) *small stature :* this does not always spell difficulty : we have seen dwarfs who had easy deliveries, but it certainly suggests the possibility of trouble : (2) as she walks into the room, her *gait* must be observed—whether there is *a limp*, or obvious difficulty in walking, for she may have *hip* or spinal disease.

This disease may be congenital or acquired. The history of childhood should be ascertained. If the age of commencing to walk was late, *rickets* should be thought of, and the presence of the rickety rosary, of the teeth, will confirm this. In addition, there may be a bowed appearance of the thighs or legs. A general examination may then reveal *kyphosis* or *scoliosis* of the lumbar region, or a somewhat twisted pelvis. If she is seen in bed for the first time she should be asked to stand up, when any of the above signs may be demonstrated.

In the later months, a *pendulous abdomen* may be present, for the presenting part cannot get into the pelvis, so the

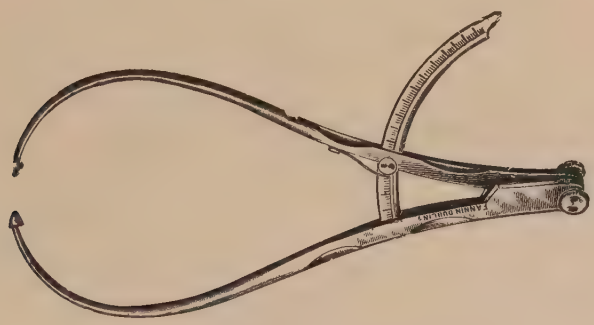


Fig. 200.—Baudelocque's pelvimeter.

abdomen falls forward, and the weight of the child rests on the abdominal wall and not on the pelvic bones.

In the last three weeks, if a malpresentation be present in a primigravida, or if the normal fixation of the presenting part has not occurred, contraction of the pelvis should be suspected. All patients should be measured externally: if these are small, further investigations must be made. If the patient be a multipara, the history of previous labours should be obtained.

Finally, we believe, in questionable cases, that the father should be interviewed to try and estimate, by an examination of his and the mother's head, what that of the child will be.

(2) **Position of the uterus.** In the early months there may be difficulty in extreme cases in the uterus rising out of the pelvis. Pendulous abdomen has already been referred to.

(3) **Pelvimetry.** In past editions we used to rely nearly entirely on pelvimetry as a means of diagnosing the exact state of affairs present in contracted pelvis. We regard pelvimetry as a necessary and enormous assistance in eradicating the mystery of some of these difficult problems in contracted pelvis, but while it is an assistance, a study of the case, using every diagnostic means at our disposal, is

Fig. 201.—How to take interspinous and intercristal measurements.

Fig. 202.—Baudelocque's pelvimeter on points for measuring interspinous and intercristal diameters.

the best way of coping with and treating them. So long as we have all our data, we should have no excuse for failure.

Pelvimetry may be *external* or *internal*. By pelvimetry we can take certain external and internal measurements. From neither method can we give a definite prognosis, but every step in diagnosis is of assistance.

External Pelvimetry. The instrument which we use is the Martin's or Baudelocque pelvimeter (see Fig. 200).

The first measurements taken are the Interspinous, Intercristal and the External Conjugate.

To measure the interspinous diameter (see Figs. 201, 202). Sit on the edge of the bed facing the patient, who lies on her back with her feet together. Cover her thighs and legs with the bedclothes. Feel for the *outer* edge of the anterior superior spines: it is most necessary to determine these points accurately, for the difference between the inside and outside points is considerable. Press the points of the pelvimeter on these outer edges, and read off the scale. The average measurement is 26 centimetres.

If the interspinous diameter can be spanned by the outstretched hand, the pelvis is contracted, but inability to do so is no proof of the absence of contraction.

To measure the intercristal diameter. This is done from the *greatest width* of the iliac crests. The points of the instrument are placed on these outer edges, and the measurement is read on the graduated scale. It is 29 centimetres.

Importance of these measurements. Theoretically speaking, if these measurements are small, the transverse diameter of the inlet is narrowed: there is, however, a fallacy in this, for the iliac fossae may be hollowed out and the iliac crests splayed, giving an impression of large measurements, when the pelvis is really contracted. If, however, both sets of measurements are diminished to any great extent, *e.g.* to 26 and 23 centimetres, transverse narrowing must be thought of, and when combined with diminution in the external conjugate, general contraction. A more important divergence from the normal is the approximation of one of these measurements to the other, *i.e.* instead of the interspinous and intercristal being 26 and 29 centimetres, they are, for example, both 26. In fact a difference of ·5 to 1·5 centimetres between the two, when combined with a small external conjugate, is pathognomonic of flattened pelvis, *i.e.* the spines are splayed out, and the promontory is pushed into the pelvic cavity.

Investigation of the charts at the Rotunda Hospital reveals the fact that while external measurements are useful, diminution does not always mean that there will be trouble in labour.

The external conjugate (see Fig. 203). This is an

important measurement and stretches from the depression below the spine of the last lumbar vertebra to just below the top of the front of the symphysis. It measures 20 centimetres, and when 17 centimetres or below, flattening of the pelvis may be suspected. A rough estimate of the size of the true conjugate can be obtained by dividing the measurement of the external conjugate by two. The measurement is taken as follows :

The patient lies on her side with knees drawn up and

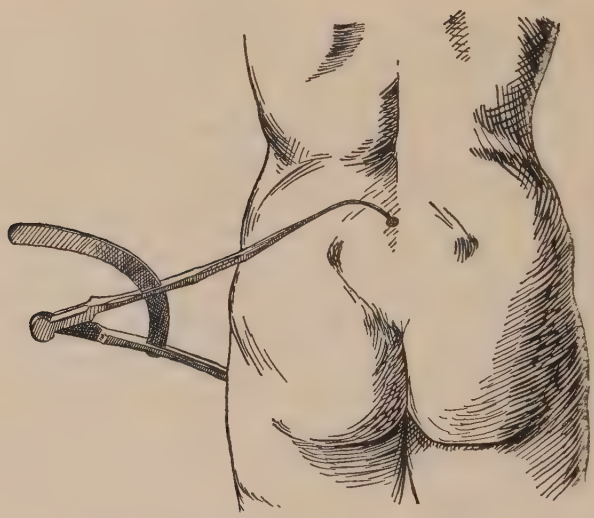


Fig. 203.—Measuring external conjugate, showing posterior point and Michaelis' rhomboid.

the body bent a little forward. One point of the pelvimeter is then placed on the depression below the spine of the last lumbar vertebra, and the other point on a spot just below the top of the front of the symphysis. By going just below the top it is certain that the instrument is on the bone. If there is difficulty in getting the posterior point, draw a line from one posterior superior spine to the other, and mark the skin 2 centimetres above the middle of that line.

Michaelis has drawn attention to a rhomboid (see Fig. 203) formed by the transverse and sacro-spinalis above, and the glutei muscles below : the line mentioned above bisects this rhomboid. Its shape may help in diagnosing the

variety of contraction; *e.g.* if the rhomboid is small, it may point to general contraction: if flattened transversely, to flattened pelvis.

These three measurements should be taken in all cases. If they are smaller than normal, there may be something wrong, but external measurements are more suggestive than precise.

In addition to these, certain measurements of the outlet should be taken, for a knowledge of contraction of the outlet may be of great assistance in determining the probable mechanism of labour in a case of disproportion. These measurements are:

(1) Posterior interspinous.
(2) Transverse of the outlet.
(3) Anterior sagittal diameter.
(4) Posterior sagittal diameter.
(5) Antero-posterior diameter of the outlet.

The first of these to be taken is the posterior interspinous, which is the distance between the two posterior superior spines of the ilium; these points are easily determinable: normally the measurement is 9 centimetres. A marked diminution in this will suggest transverse narrowing: this measurement is taken with the patient lying on her face: the Martin's pelvimeter is used.

Reference has been made already (see p. 102) to the outlet of the pelvis. We measure the *transverse diameter of the outlet* from the innermost margins of the anterior portions of the tuberosities of the ischium: this line passes *immediately in front of the anal orifice:* it is a most important point, for it is used in taking both sagittal diameters. The *posterior sagittal* diameter is one of the chief measurements of the outlet. It extends from the last piece of the sacrum to the middle point of a line joining the tubera ischii, *i.e.* to just in front of the anal orifice. It is just as important as the *anterior sagittal* is unimportant, for the posterior sagittal diameter is the chief portion of the outlet which the head traverses in the process of delivery. This latter diameter extends from below the symphysis pubis to the point in front of the anal orifice.

The *antero-posterior* diameter of the outlet is very movable and stretches from the lower border of the symphysis to the tip of the coccyx: this mobility is due to the coccyx: it has really very little significance in mechanism.

Outlet narrowing alone is rare: in continuation with inlet contraction it is common. In order to have full information the above measurements should be taken. First the posterior interspinous is taken: when diminished, it suggests transverse narrowing: a small transverse of the outlet makes the suspicion greater. The normal is 9 centimetres: it may be taken with a calipers, but we have lately got better results by the use of a piece of string stretched between the points and then placed over the scale. The pelvimeter of Acosta-Sison may be used for the purpose.

It will be seen that the size of the posterior sagittal diameter will have a great influence on labour, for even if the transverse of the outlet is much lessened, a compensating increase in the posterior sagittal will make up for this. We regard the necessity for taking this measurement as being of much importance.

There is so little space in the *anterior sagittal* diameter that it is scarcely worth taking. Normally it measures 5·5 centimetres. The antero-posterior diameter of the outlet is movable, but when the coccyx is stretched backwards it is about 13 centimetres. It can be taken with the Martin's pelvimeter.

Finally, we palpate the subpubic angle: if two fingers can be fitted below it, it is unlikely that there is transverse narrowing of the outlet.

To sum up the measurements taken:

Interspinous	26	centimetres
Intercristal	29	,,
External conjugate . . .	20	,,
Posterior interspinous . . .	9	,,
Transverse of the outlet . .	9	,,
Anterior sagittal . . .	5·5	,,
Posterior sagittal . . .	10	,,
Antero-posterior of the outlet .	13	,,

The next step in the diagnosis of the case is **Internal**

Pelvimetry. There are several ways of doing this. The true conjugate can be ascertained in a haphazard sort of way by measuring the diagonal conjugate.

Measuring the diagonal conjugate (see Fig. 204). The patient is in the cross-bed position, with her legs drawn upwards. The first two fingers of the right hand are passed into the vagina so that the tip of the middle finger touches the promontory of the sacrum: the point where the radial side of the index finger strikes the inferior margin of the pubes is marked. With a measuring rod an estimation is

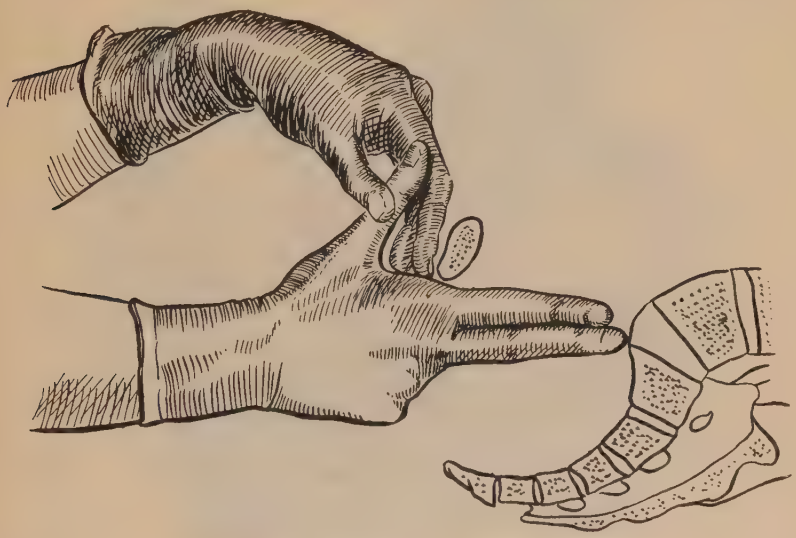


Fig. 204.—Measuring the diagonal conjugate.

then made from that point to the top of the middle finger. On deducting 2 centimetres from the measurement, the true conjugate is approximately ascertained. This is a rough-and-ready method of obtaining the true conjugate. The most satisfactory way is to use a pelvimeter. We perform all our measurements with the Skutsch pelvimeter, and confirm them when possible by means of X-rays.

Skutsch Pelvimetry (see Fig. 205). Two diameters are to be measured: namely, the true conjugate and the true transverse. For measuring these, which are by far the most important, Skutsch devised his ingenious pelvimeter, and so efficient is this instrument, that we have found that

anyone accustomed to its use is able to get accurate measurements. We shall not describe the instrument. It must be handled and its use learnt before starting to work with it.

First measurement. First feel for the front of the top of the pubes, and put a cross with ink or a dermatograph pencil over the spot. Pass the first two fingers of the left hand into the vagina and feel for the sacral promontory. The true promontory is formed by the wedge-shaped piece

Fig. 205.—Measuring with Skutsch's pelvimeter.

of cartilage between the last lumbar vertebra and the sacrum. There will be no difficulty in identifying it, for the last lumbar vertebra slopes back immediately above it; in other words, it is the most prominent part. The junction between the first and second sacral vertebrae is sometimes very prominent in flattened pelvis, forming what is known as a false promontory. This may be mistaken for the true promontory, but can be distinguished from it by the absence of the wedge-shaped piece of cartilage. Before inserting the rigid limb of the pelvimeter see that the points of the arms

are opposite each other and on the same plane. Push the rigid limb of the pelvimeter, with its point turned backwards, up to the promontory, and keep it pressed against the promontory by the finger-tips. When the rigid bar is in place the point of the mobile arm should be brought opposite

Fig. 206.—First measurement, Skutsch's pelvimeter.

the ink mark by manipulating the stiff arm rather than by bending the flexible arm. Get the assistant to put the point of the flexible bar on to the skin mark over the pubic bone, so that it just touches the skin without indenting it. Withdraw the instrument carefully, so that the limbs are not forced apart at all. When the instrument is withdrawn there

is great likelihood of separation. There is a shoulder on the connecting arc that allows separation of the limbs during removal and subsequent accurate readjustment. Measure between the points with a rigid steel measure, marked either in inches or centimetres.

We always repeat each measurement three times. If there is any gross difference between the measurements we know that we are mistaking the promontory, but as a matter of fact we find our three measurements are nearly always identical, or at the most differ by one-fifth of an inch. If there is this difference, take the average.

Second measurement. It is inconvenient to turn the rigid limb twice, so next measure the distance from the skin over one trochanter to the furthest point of the internal transverse boundary of the pelvic brim on the opposite side. Make a cross on the skin over the left trochanter. Bend up the patient's thighs on her abdomen and flex her legs. With the right half hand in the vagina feel for the widest point on the right ilio-pectineal line. Push the stiff limb up and hold it to this point. The assistant then presses the flexible limb down to the skin mark, so that it just touches but does not indent the skin. Withdraw carefully, separating the limbs while doing so, and readjust before measuring. Measure the distance between the two limbs. Repeat three times. This is the only measurement in which there is likely to be any discrepancy between the three measurements, both because the widest point is a little difficult to locate and the limbs may be separated in withdrawal. The use of the shoulder on the instrument avoids the latter risk. Learn the use of the shoulder before measuring. By its use the limbs can be widened for removal, and when outside restored to the original position. In practice we find the first attempt at each measurement the least accurate, probably because the stiff arm does not at first sufficiently indent the soft tissues. In relocking the limbs back on to the shoulder of the cross-bar the greatest care must be exercised, for the least jerk or violence will cause the leaden arm to bend, and render the measurement inaccurate.

Third measurement. Turn the rigid bar round so that its curved tip points towards the flexible limb instead of

away from it. Pass two fingers into the vagina and place them on the back of the pubes. Pass the tip of the rigid bar up to them and hold it against the back of the most prominent part of the pubic bone. The assistant lightly applies the flexible limb to the spot marked on the skin over the centre of the pubes. Withdraw and measure. This gives the thickness of the symphysis and soft parts covering it. Repeat three times.

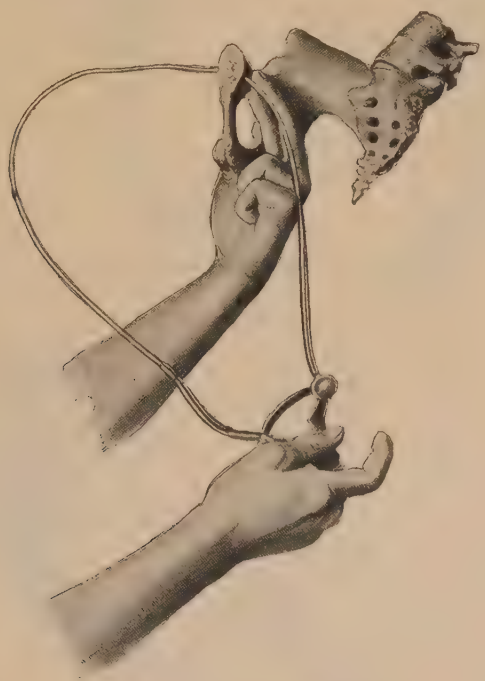


Fig. 207.—Third measurement.

Fourth measurement. Again bend up the patient's thighs and legs. Put the left hand into the vagina and feel for the widest point of the left transverse border of the brim. Hold the point of the stiff limb to this spot. The assistant lightly applies the flexible point to the spot on the skin over the left trochanter. Separate the limbs a little, withdraw, readjust, and measure. Repeat three times. This measurement gives the thickness of the parts between the left transverse border and the skin over the left trochanter.

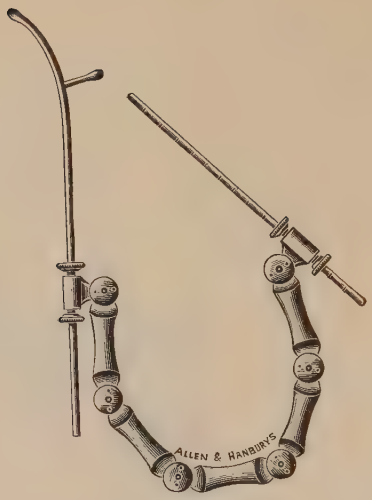


FIG. 208.—Tottenham's pelvimeter.

Fig. 209.—Tottenham's pelvimeter.
S, promontory of sacrum; P, pubes.

Deductions from these measurements. The first measurement gives the antero-posterior diameter of the brim plus the thickness of the pubes and soft parts over it. The third measurement gives the thickness of the pubes and soft parts over it. By deducting the latter from the former an accurate measurement of the true conjugate of

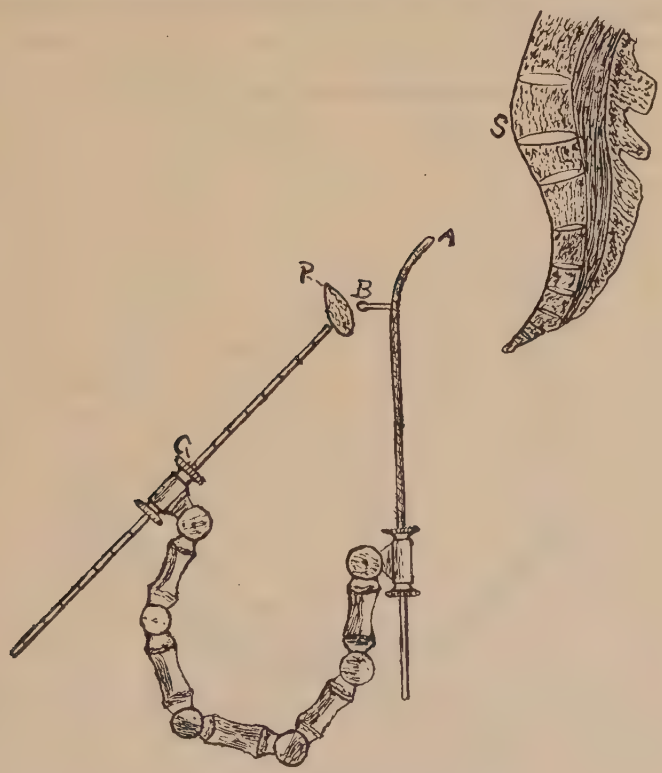


Fig. 210.—Tottenham's pelvimeter.
s, promontory of sacrum; p, pubes.

the brim is obtained. The second measurement gives the transverse diameter of the brim plus the thickness of bone and soft parts between the ilio-pectineal line and the skin over the trochanter. The fourth measurement gives the width between the ilio-pectineal line and the skin over the trochanter. Deducting the latter from the former gives the true transverse diameter of the brim.

Thus, by this instrument, accurate measurements of the

pelvic brim are obtained. We recommend it strongly, for with a little practice outside the body, and understanding how to work with it, we think accurate measurements should be obtained.

Tottenham's Pelvimeter (see Figs. 208, 209, 210, 211). We sometimes use this pelvimeter, which is specially pleasant in taking the measurement of the true conjugate: the transverse measurement may also be taken. Tottenham

FIG. 211.—Tottenham's pelvimeter arranged for taking the external measurements. The distance between the converging points is measured with the straight rod, as above.

claims that it is simpler, very much more accurate, and less liable to get out of order than that of Skutsch; the measurements being taken in a somewhat similar manner. He describes the instrument as follows:—it is composed of a series of five hinged links, each link being about three inches long and somewhat flattened from side to side. The terminal link at each end has an adjustable head; one of these heads carries a straight rod, which is calibrated in centimetres (up to 35). The latter moves freely through the head-piece, and can be adjusted to the skin, thus cor-

responding to the lead leg of Skutsch's pelvimeter. The other head-piece carries a rod about thirteen inches long, somewhat curved at one end, which terminates in a ball point, *A*; at *exactly* 7 *cm.* from this point there is a second ball point, *B*, thus making the end of the rod somewhat Y-shaped; either limb of the Y can be used to measure from, and thus the instrument need not be removed from the vagina to reverse the rod, as has to be done with Skutsch's pelvimeter.

When measuring the true conjugate—(1) Fix the instrument in the position shown in Fig. 208, and push the straight calibrating rod up to ball point *B*; note the number of centimetres at *C*; suppose it be 25, then *B* is 25 cm. from *C*, and *A* is (25 + 7 cm.) 32 cm.; for *A* is 7 cm. from *B*. (2) Make a vaginal examination and apply point *A* to the promontory of the sacrum; adjust the straight rod until it touches the skin over the pubes (Fig. 209) (the same spot is taken as described on p. 439). Without removing the instrument note the reading at *C*; if it be 18 cm., then the distance from the skin over the pubes to the promontory is 32 — 18 cm. = 14 cm. (3) Without removing the curved rod from the vagina, bring ball point *B* in contact with the back of the pubes, adjusting the straight rod to the skin as before (Fig. 210), and noting reading at *C*, suppose the latter to be 21 cm.; then as *B* was found to be 25 cm. from *C*, therefore 25 — 21 represents the thickness of the pubes = 4 cm. Hence the conjugate is 10 cm. (14 — 4 cm.).

X-ray Pelvimetry. This is extraordinarily useful and valuable. Although is it not so suitable and practical for the general practitioner, it should be used by the specialist.

The method of X-ray pelvimetry as practised by McDonogh at the Rotunda Hospital is, with slight modification, that originally devised by Herbert Thoms, New Haven, Conn.

The patient is placed in the semi-recumbent position, with the back well arched. Measurements are taken from a point one centimetre below the superior border of the symphysis pubis, and from the depression below the spinous process of the fourth lumbar vertebra, to the surface of the Bucky diaphragm, on which the patient lies, and her position

is adjusted until these points are equal, when the inlet will lie in a plane horizontal to that in which the film is placed (see Fig. 212).

A lead strip, reinforced for the sake of rigidity, and having fine saw cuts at one-centimetre intervals, is placed close alongside the patient in the same plane as the inlet, and a

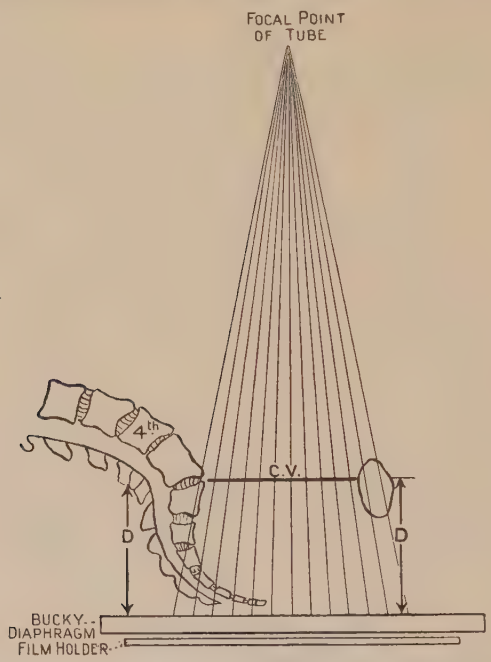


FIG. 212.—Diagram showing position necessary for X-ray pelvimetry. When D.D. are made equal, C.V. will lie in a plane horizontal to that of film. If a centimetre (lead) scale is placed alongside the patient at a height D., the amount of distortion of the pelvic inlet and the scale will be the same and the dimensions of the former may be obtained by direct comparison with the image of the scale which appears on the film.

film exposed with the tube centred over the middle line five centimetres above the pubis.

The resulting negative shows the pelvic outlines and a series of linear markings produced by the lead strip (see Fig. 213 and Figs. 293 and 294 in Appendix). As the inlet and the lead scale were at the same distance from the film, it is obvious that the distortion due to dispersion of the rays will have been equal in each case, and that therefore the

diameters of the inlet may be obtained by direct comparison with the scale markings on the negative.

Similarly, by placing the patient in the lateral position with the lead scale at the level of the mesial line, several useful measurements can be obtained.

A very close approximation to the dimensions of the head is given by direct comparison with the shadow of the lead scale on the negative already used for measuring the inlet.

With the dry pelvis the error does not amount to more than two millimetres, but in the living subject the measurements obtained by the X-ray method will be slightly greater

Fig. 213.—Diagram of the view of pelvis obtained, together with image of the lead centimetre scale by means of which measurements may be made direct from film.

than by other pelvimetric methods which take into account the thickness of the soft tissues. The variation due to this factor amounts to about one-half centimetre.

Using a flat rotary type Bucky diaphragm, two intensifying screens, and with the tube at a distance of 85 centimetres from the film, a current of 30 m.a. at 80 K.V. (peak) gives, with a seven-seconds exposure, a satisfactory picture of the pelvis and head when the patient is nearing term.

The next step in diagnosis is to endeavour to find out how the head fits the pelvis. The head has been described as the most efficient pelvimeter, and the method in which it fits the brim is an effective complement to the pelvimetry already done. The following methods are most useful.

I. External.

(*a*) **Müller's method.** If the abdominal walls are not relaxed, an anaesthetic is given. The obstetrician stands up with his back to the patient and pushes on the occiput and forehead in the direction of the axis of the inlet.

Müller suggested doing this at intervals, with a view to ascertaining the exact date when to induce labour. The first day on which the head failed to fit into the brim was the day to induce labour.

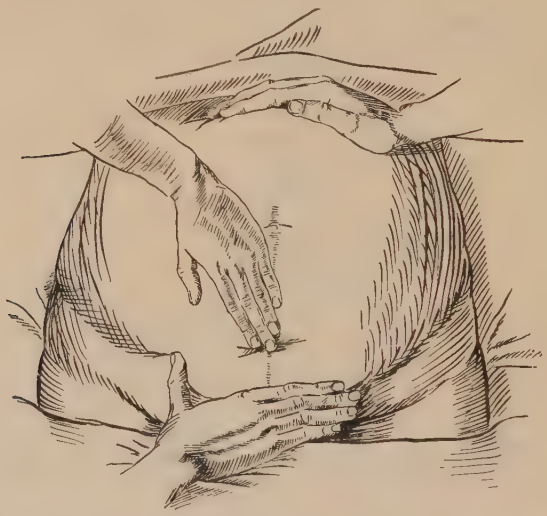


Fig. 214.—Solomons' modification of Müller's method.

(*b*) The **author's** (Solomons') modification (see Fig. 214). The obstetrician sits by the side of the patient and grasps the head as in the Pawlik grip; the fingers of the other hand, placed flatly on the head, press it down gently, while an assistant presses down the foetus from the fundus.

II. Combined method.

The Müller-Kerr procedure (see Fig. 215). The obstetrician sits down and passes two fingers of the right hand into the vagina, with the palmar surface anterior: he then presses the head downwards into the pelvis, with the fingers on one side of the head, the thumb on the other. The bimanual examination reveals the "fit" of the head into

the pelvis, while the right thumb is placed over the pubes and determines the amount of overriding. He next determines in the event of the head being pushed down how far it will go, and its relation to the ischiatic spines is of great value. In a simple case the head may press down nearly to the lower strait, *i.e.* right past the ischiatic spines: and the idea is conveyed to the observer that only the

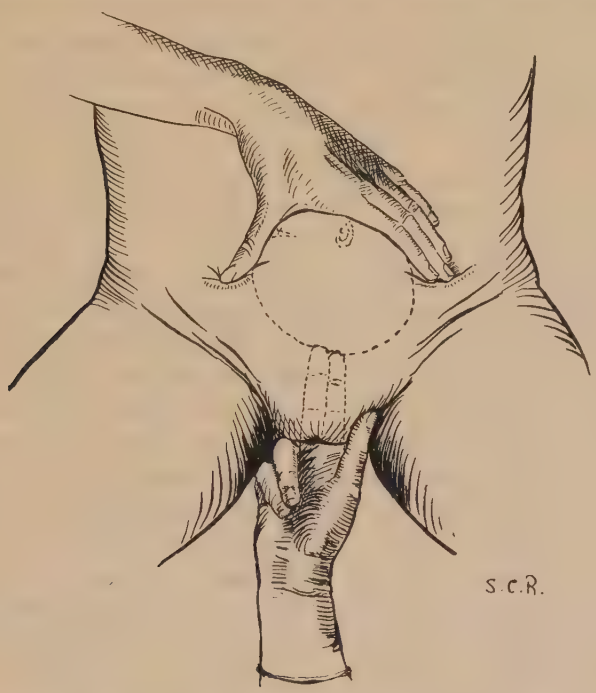


Fig. 215.—The Müller-Kerr estimation.

soft parts prevent the birth of the baby; in the second class, the head fits down *to* the level of the ischiatic spines.

In the absolute non-fitting class, where pelvic delivery appears impossible, the head is obviously quite obstructed in the superior strait, and abdominal delivery is the treatment of choice. When the head passes the promontory, great care must be taken that it really does pass it, for a false impression may be got if the head pushes down into the concavity of the sacrum; at the same time the other

side of the head passes upwards. Any transverse overriding must be noted. In deciding on the relation of the head to the bony pelvis, the consistency of the former must be taken into account. The soft head allows moulding, and hard bones make the prognosis for delivery less favourable. When the breech presents it must be turned in order to make the Müller estimation. If, however, it is impossible to do this, the trial of labour becomes a more difficult matter. The Müller examination under anaesthetic may also remove an apparent fallacy. *Prematurity* may simulate disproportion, so that when a high head is encountered, this must be thought of.

It is difficult to explain fully the Müller estimation: it requires great practice. Experience alone is the guide to knowledge of this class of case.

Having made out by these different manœuvres that the labour is likely to succeed in delivery, information can be got by a careful examination of the abdomen and the pelvis. The *shape* of the uterus should be noted. It should be rather pyriform in outline—not transverse. The uterus should not be *over-full* or tense, for this may show that the foetus cannot get into the pelvis and that it must crowd out the abdomen, thus making manipulation difficult. Pendulosity should be noted. The presentation must be diagnosed and malpresentations corrected if necessary.

A careful estimate of the pelvis will aid in giving a prognosis as to the chances of pelvic delivery. This must be done in a routine manner as follows.

The Pubis. Its thickness is first noted, but this is only of importance where Skutsch pelvimetry has not been practised. Its *inclination* is next noted, and the special importance in this is in considering the amount to deduct in estimating the true conjugate from the diagonal—a method of estimation which we do not recommend. Its *height* is of importance chiefly in trying to make out the distance which the head has to descend to bring the occiput under the pubis for extension to occur: this may be an important point in some cases of contracted pelvis, especially outlet contraction.

The finger is then placed at the back of the symphysis to

note any rachitic roughness which might lessen the diameter through which the head must travel, and the *subpubic* angle is estimated. The latter should in a normal case admit two fingers: if this is not possible, it means possibly that transverse contraction of the outlet exists. Finally, measurement to determine the angle which the head makes with the top of the pubis by external examination, and the amount of room between the head and the pubis on internal examination, must be taken. It is perfectly obvious that when the head does not fit, a marked angle will be felt between the pubis and the head outside, while non-adaptability will be ascertained by the "vaginal" fingers.

The Sacrum. First feel for the *promontory*. If it can be felt easily with the two fingers in the vagina, the pelvis is likely to be contracted. Its *height* should be noted to show its relation to the symphysis. In addition, the fact that it *overhangs*, and the presence of a *double* promontory, may both affect the prognosis. The *sacral alae* should be examined: normally, two fingers can be placed on these: if only one finger fits, it points to straightening of the ilio-pectineal line, with possible diminution of the transverse diameter of the inlet. The curve of the sacrum is next estimated: the normal curve is in a gentle slope. Should there be a "dinge" half-way down which increases the concavity forwards, it may act as a bar to proper descent. In a normal pelvis not more than the three last vertebrae can be palpated. The ischiatic spines should then be palpated and their prominence determined. Finally, any other abnormality should be observed and noted by careful palpation of the inside pelvic walls with the fingers.

Varieties of Contracted Pelvis, with Diagnosis and Mechanisms.

While the following list of contracted pelves is given, the consideration from a practical point of view will fall, to a large extent, under the headings:

Flattened pelvis, generally contracted pelvis, with or without flattening, and transverse contraction.

Contracted pelves may be divided into—

The Justo-Major and Justo-Minor Pelves.

Six Pelves flattened from before backwards.

(1) Simple flattened pelvis.
(2) Rachitic flattened pelvis.
(3) Generally contracted flattened pelvis (rachitic).
(4) Generally contracted flattened pelvis (non-rachitic).
(5) Split pelvis.
(6) Spondylolisthetic pelvis.

Six Pelves flattened from side to side.

(1) Naegele's pelvis.
(2) Roberts's pelvis.
(3) Pelvis due to imperfect development of the sacral vertebrae.
(4) Assimilation pelvis.
(5) Funnel-shaped pelvis.
(6) Kyphotic pelvis.

Six Pelves irregularly distorted.

(1) Osteo- or pseudo-osteomalacic pelvis.
(2) Scoliotic pelvis.
(3) Kypho-scoliotic pelvis.
(4) Pelvis of hip disease (coxalgic).
(5) Pelvis with bony or cartilaginous tumours.
(6) Pelvis affected by old fracture.

The justo-major pelvis. In this pelvis all the measurements are increased. It may be found in normally built women, but is more commonly found in giantesses. Its obstetrical importance is that it may cause precipitate labour (p. 414).

The justo-minor pelvis. In this pelvis all the measurements are decreased. The result is a small, generally contracted pelvis—the small round pelvis. It is one of the commoner forms of contracted pelvis. No cause is known, for although it occurs usually in small women, or dwarfs, it is also found in women whose well-developed condition does not suggest an ill-developed pelvis. The general diminution in the length of the diameters is not more than half an inch; if more, there is also flattening, and the pelvis is the generally contracted flattened pelvis.

Six Pelves flattened from before backwards.

(1) **Simple flattened pelvis.** In this pelvis the sacrum and the sacral promontory sink downwards and forwards more than normal. A certain amount of sinking of the sacrum has been described as normal to the development from the foetal to the adult type of pelvis, but in this pelvis the normal degree of such sinking has been surpassed. The reason for this has been said to be due to carrying heavy weights in childhood, or to weakness of the ilio-sacral ligaments, but definite proof is wanting. It is the commonest

Fig. 216.—Flattened pelvis.

form of contracted pelvis, and slight degrees of it are frequently found. The contraction is, as a rule, not great.

Characters of a simple flattened pelvis. The interspinous and intercristal measurements are usually normal, but the external conjugate is about 18 centimetres.

Internal pelvimetry may show a diminution of the true conjugate to 8–5 centimetres. If it is less than this, it is probably rachitic in origin, although the carrying of heavy weights in childhood has been suggested as a cause. It is unlikely that this pelvis will cause difficulty in labour.

(2) **Rachitic flattened pelvis.** Rickets occurring late in childhood is apt to cause considerable pelvic contraction. The forces which operate in moulding the infantile into the adult pelvis are here exaggerated.

The wedge-shaped sacrum is driven further downward and forward, forcing the ilia farther apart, thus causing proportionate, and sometimes even absolute, increase in the transverse diameter.

The promontory moves forward and causes increased prominence of the posterior superior spines of the ilium; this also helps to give the peculiar transverse ridge on the back, so characteristic of rachitic *flattened* pelvis.

On account of the forward and downward movement of the sacrum, with consequent increased prominence of the posterior superior iliac spines, the sacro-iliac ligaments exert a greater force on the front part of the pelvis, causing an increase in the curve of the ilio-pectineal lines, and in the size of the sub-pubic angle.

The changes in the **Sacrum** are as follows :

(1) Broader from side to side.

(2) Shorter from above down.

(3) Either more concave, that is, with an acute angle about the level of the third vertebra, or occasionally it is straighter.

(4) Thinner from behind forward.

(5) Straighter from side to side.

(6) A certain amount of upward and backward dislocation which increase the length of the antero-posterior diameter of the outlet.

In addition, the transverse diameter of both inlet and outlet may be increased, while the approximation of the anterior and posterior walls causes a shortening of the oblique diameters.

The transverse diameter of Michaelis' rhomboid is increased.

The concavity of the sacrum from above downwards is greatly increased, but the concavity from side to side is diminished, because the bodies of the sacral vertebrae move forward to a greater extent than the alae.

In addition to these changes there is another which is characteristic of the rachitic flattened pelvis, that is, splaying outwards of the crests of the ilia. The inner aspects of the bones are easily palpated, and the transverse measurement between the anterior superior iliac spines is propor-

tionately greater than that between the crests. Instead of the normal difference of one and a quarter inches, the interspinous diameter may be equal to, or even greater than, the intercristal diameter.

This splaying of the ilia has been attributed to the intra-abdominal pressure, and to the force of the thigh muscles acting on the softened bones. That this is not the true explanation is apparent from the fact that this deformity has been observed in antenatal rickets, and does not occur in osteomalacia.

(3) **The generally contracted flattened pelvis (rachitic).** This is one of the commonest forms of contraction. Rickets is a disease that is liable to arrest development in the bones. When this occurs, general contraction is added to the flattening already described.

(4) **The generally contracted flattened pelvis (non-rachitic).** This pelvis is a combination of general contraction (justo-minor) and simple flattening. In other words, a woman with general contraction may be subjected to influences causing downward and forward rotation of the sacrum, for instance, the carrying of heavy weights in childhood.

This is an uncommon form of contracted pelvis.

(5) **Split pelvis.** In this pelvis there is failure of union between the pubic bones at the symphysis. Extrophy of the bladder is a common accompaniment. In consequence of this failure the pelvis becomes widened out laterally, and is flattened from behind forwards. Delivery in these cases is simple.

(6) **Spondylolisthetic pelvis** (see Fig. 217). The cause of this condition is not known. It is supposed to be due to inflammatory softening of the intervertebral disc which causes the displacement of the last lumbar vertebra downwards. Under ordinary circumstances it would be impossible for a woman to stand erect with the lumbar vertebrae in such a position. She can only do so by throwing her head back and, by constant effort, gradually bringing about the exaggerated lordosis seen in these cases. Considerable encroachment upon the antero-posterior diameter of the brim results. The patient with spondylolisthesis of any

degree shows considerable lordosis, which produces great shortening of the waist, so that the ribs rest upon the iliac crests. There will be a waddling gait. The dip of the fifth lumbar vertebra is seen and felt from behind, and can be diagnosed for certain on finding the lumbar vertebra in front of the sacrum.

The treatment is as for other forms of flattened pelvis. If the conjugate measured from the false promontory is under 8 centimetres, pelvic delivery is most improbable.

Fig. 217.—Spondylolisthetic pelvis (after Bumm).

Six Pelves flattened from side to side.

(1) **Naegele's pelvis** (see Fig. 218). Naegele's pelvis is due to failure of development of the lateral sacral mass on one side. On the affected side there is a firm synostosis between the sacrum and ilium, a diminution in the breadth of the innominate bone, and in the width of the sacro-sciatic notch. The sacrum is rotated and displaced towards the diseased side, and there is a compensating scoliosis in the lumbar part of the vertebral column. The symphysis is displaced towards the sound side and is not opposite the promontory. The ilio-pectineal line on the affected side is but slightly curved.

All these changes are readily understood if it is remembered that the leverage of the sacro-iliac ligaments on the posterior superior spines is lost because of the ankylosis of the sacro-iliac joint.

The result is that the pelvis is contracted obliquely, with shortening of the oblique diameter starting from the sound side. The true conjugate is usually unaltered. The transverse diameter is shortened.

Naegele's pelvis is commoner than has been thought up to the present. There is no abnormality of gait or figure to lead one to suspect its existence. The external measurements lead to the diagnosis. Measurements vary. Usually the interspinous, intercristal, and external conjugate are

Fig. 218.—Naegele's pelvis.

normal, but there are certain other measurements which will define the diagnosis. Many have been suggested, but we shall only give those we have found useful.

(1) The distance from the top of the sacrum to the tuberosity of the ischium on the diseased side is much less than that on the sound side.

(2) The distance between the tuberosity of the ischium on the affected side, and the posterior superior spine on the sound side, is less than that between the tuberosity of the ischium on the sound, and the posterior superior spine on the affected side.

(3) The tip of the last lumbar vertebra is nearer to the anterior superior spine on the diseased than on the sound side.

In suspected cases a skiagram will give useful information. Labour, with Naegele's pelvis of a slight degree, will result in natural, uninterrupted delivery.

(2) **Roberts's pelvis.** This has also been called a double Naegele pelvis. Both lateral sacral masses fail to develop, and there is synostosis between the sacrum and ilia. The posterior superior spines are as a consequence much closer than normal, and the pelvis is greatly flattened from side to side. Caesarean section has been necessary in nearly all reported cases.

(3) **Pelvis due to the imperfect development of the sacral vertebrae.** The sacrum itself may be so ill-developed that great transverse narrowing results.

(4) **Assimilation pelvis.** Not infrequently, the last lumbar vertebra develops lateral masses and becomes united to the sacrum, so that the sacrum consists of six pieces instead of five. The result is that the pelvic canal is longer and deeper, and is more or less funnel-shaped, with small outlet and transverse flattening. If the deformity is not great, obstruction at the outlet may be its first indication.

(5) **Funnel-shaped pelvis.** This condition is generally regarded as a persistence of the infantile type of pelvis, in which the pelvic cavity is straighter, longer, and narrower transversely than the adult pelvis, and narrows as it approaches the outlet, where obstruction to the passage of the child's head, if it has passed the brim, will occur.

The importance of outlet narrowing should not be lost sight of, and a routine measurement of the pelvis as suggested on p. 430 will obviate the error of missing outlet contraction. It is usually due to high assimilation, *i.e.* six sacral vertebrae. The prognosis will depend on the length of the antero-posterior diameter, especially the posterior sagittal diameter: if it be diminished, and the transverse of the outlet is under 8 centimetres, the outlook is grave.

(6) **Kyphotic pelvis.** Kyphosis in the lower lumbar region pulls the sacrum backwards, and the result is, therefore, the opposite of the flattened pelvis.

The promontory is pulled upwards and backwards. In consequence the posterior superior spines are indistinct.

The lower part of the sacrum moves forward, thus diminishing the antero-posterior diameter of the outlet. The ilia and ischia approach each other because of the backward displacement of the sacrum. Therefore the transverse diameter of the outlet is shortened. There is a reduction in the lever force of the sacro-iliac ligaments acting through

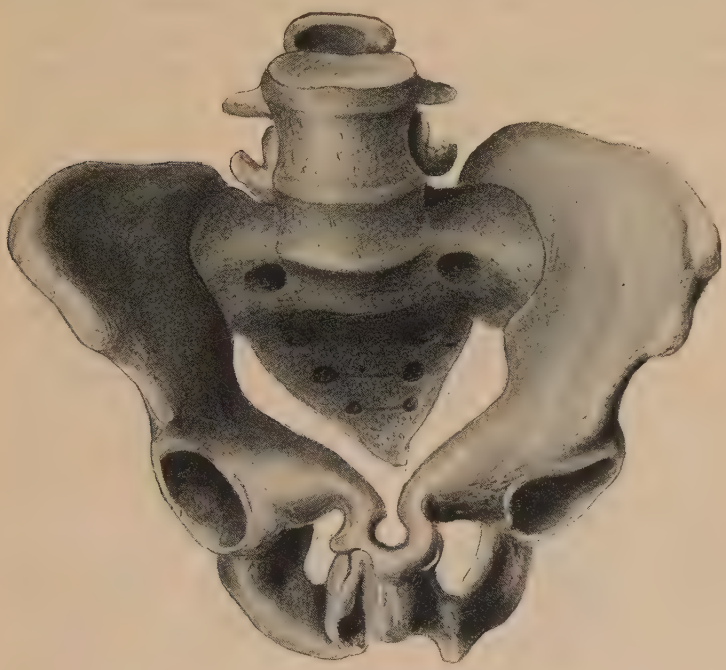


Fig. 219.—Osteomalacic pelvis.

the posterior superior spines; this lessens the curve of the ilio-pectineal lines and makes the pubic angle more acute.

Obstruction occurs at the outlet.

Six Pelves irregularly distorted.

(1) **Osteo- or pseudo-osteomalacic pelvis** (see Fig. 219).

Cause of Osteomalacia.

(1) Bacteria.
(2) Lactic acid in the blood.
(3) Ovarian disease.
(4) Suprarenal disease.

Symptoms. (1) Muscular pains followed by (2) rheumatic pains. (3) These are followed by deformities in the pelvis which make the bones yellowish, and so soft and brittle that they can be cut with a knife. (4) Diminution in stature.

Osteomalacia is a disease of the bones, usually occurring in pregnant women, in which the bones themselves become soft from loss of the salts. Clinically it is characterised by considerable pains, tenderness over the bones, and finally

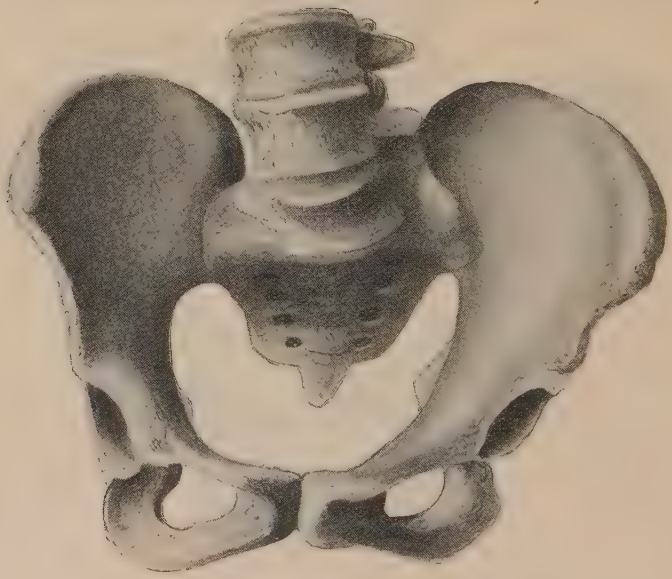


Fig. 220.—Scoliotic pelvis.

inability to walk, with great deformity of the pelvis, spinal changes, and spontaneous fractures of the long bones.

The deformity depends on the degree of softening of the bones. In some cases the bones are crumpled inwards and the pelvic cavity becomes triradiate, while the pubic bones project forwards almost like the beak of a bicycle saddle, and can be taken between the fingers.

The best treatment for arrest of the disease has been found to be double oöphorectomy, especially in young women. Lately a cure of the disease has followed daily injections of ♏ x to xv of adrenaline. Pituitrin in repeated doses is also recommended.

The pseudo-osteomalacic pelvis is one in which a similar triradiate contraction of the canal, due to crumpling of the bones inwards, is found. It is not, however, due to osteomalacia, but to rickets of a severe degree occurring in late childhood. The splaying outwards of the anterior superior spines marks the rachitic form.

(2) **Scoliotic pelvis** (see Fig. 220). Scoliosis is as a rule due to rickets, and when it occurs high up in the spinal column is compensated by an opposing bend lower down, and the pelvis is left unaffected. When, however, the scoliosis occurs in the lumbar vertebrae, distortion of the pelvis is caused. The sacrum becomes twisted with the lumbar vertebrae, and the pelvis becomes obliquely contracted. In addition to the actual deformity resulting from the scoliosis, as a rule the further deformities of rickets are added, and considerable distortion results.

(3) **Kypho-scoliotic pelvis.** Still further complications in the shape of the pelvis are caused by the combination of kyphosis and scoliosis. The actual kind of contraction produced depends on whether the changes due to scoliosis, or those due to kyphosis, predominate.

(4) **Pelvis of hip disease.** When hip disease occurs in early life, deformity of the pelvis results from the absence of pressure of the affected femur with consequent oblique contraction. In addition to this, especially when the patient has had a long time in bed, there is atrophy of the bones; and furthermore, when the patient begins to walk, tilting of the pelvis and scoliosis come to balance the shortening of the affected hip. This combination of events produces considerable distortion of the pelvis. The contraction is greater on the sound side.

(5) **Pelvis with bony or cartilaginous tumours.** Distortion of any nature may result.

(6) **Pelvis affected by old fracture.** Great distortion of the pelvis may result from fracture of the bones, if the patient is fortunate enough to recover.

Frequency of Abnormal Pelvis.

With the exception of the simple or rachitic flattened pelvis, the generally contracted pelvis, and the assimilation

pelvis, abnormal distortion of the pelvic canal is fortunately rare, so rare in fact that it is the rule rather than the exception for a general practitioner to go through life without seeing any one of the rarer forms.

Should, however, one of the rarer forms be met with, the treatment should be conducted as for the commoner forms of contracted pelvis.

The mechanism of contracted pelvis.

1. In general contraction.

The mechanism which occurs in the small generally contracted pelvis is very similar to the normal, but depends to a large extent on whether the contraction is general, or tends more to the flattened type : if the latter, the mechanism is as in flattened pelvis, but if the antero-posterior shortening is not well marked, extreme flexion occurs after engagement in one of the oblique diameters. The labour will probably be slow, for the whole pelvis is small.

All the signs of disproportion are present early in the labour, and the small fontanelle is found to present on vaginal examination.

2. In flattened pelvis.

The mechanism in all types of flattened pelvis is much the same, and the steps are as follows :

As the true conjugate is shortened, the head engages in the transverse diameter. The bi-parietal diameter is too large, so the smallest transverse diameter of the head is substituted—the bi-temporal diameter, 8 centimetres : this means, of course, that flexion is not complete, so that the large fontanelle will probably present. The sagittal suture is in the transverse diameter of the inlet. An *anterior parietal* presentation or even an ear presentation may result. Uterine contractions cause descent of the anterior parietal bone past the pubes (anterior asynclitism). After this has occurred, the posterior parietal bone, which was displaced upwards, now finds its way, and the force of uterine contractions causes the posterior parietal bone to pass the promontory, in the process of which the soft parts of the head may be injured. Once the head has passed the

superior strait, flexion and internal rotation occur, and the remainder of the birth is as in ordinary mechanism.

Sometimes the reverse happens (posterior parietal presentation), when the posterior parietal presents and the sagittal suture is close to the symphysis : in this mechanism, which is rare, the posterior parietal bone sweeps past the promontory and is followed by the anterior parietal bone.

When the pelvis is generally contracted and flat, the mechanism will depend on which is the most important factor.

Mechanism in breech presentation with contracted pelvis.

The after-coming head chiefly concerns us in this. It usually comes through the pelvis in the same way as the fore-coming, *i.e.* the sagittal suture is in the transverse diameter when the pelvis is flattened, while complete flexion occurs in the generally contracted type if delivery is possible.

Special points in other mechanisms.

Funnel-shaped pelvis. There may be difficulty in this type of case because of the narrowing of the sub-pubic angle. The occiput cannot get beneath this angle and so must reach some point on the ischio-pubic rami before extension can occur. Sometimes it must reach a line joining the tuberosities. A very large diameter of the head must therefore come down to distend the perineum, which will probably be badly torn.

The soft parts in cases of contracted pelvis. In considering the mechanism of contracted pelvis, it must be remembered that the long measurements are lessened to a certain extent by the muscles. In addition, although the presenting part may, by the ordinary steps of mechanism, pass through the contracted portions of the birth canal, delay is often experienced by the cervix not having been taken up, or occasionally even by thickened membranes. Usually non-taking-up of the cervix is associated with disproportion, and in these cases a careful examination must be made to find out if the head is really through, and if it is only a question of time for the cervix to be obliterated.

Moulding in contracted pelvis. In most instances the parietal and frontal bones are under each other, and the occipitals are beneath the parietals. The latter may be indented or even fractured, especially in flattened pelves.

The Treatment of Contracted Pelvis and Disproportion.

The correct treatment depends very largely on correct diagnosis, and if every effort is made to follow the rules for diagnosis as already outlined, treatment, except in very unusual cases, should be a simple matter.

There are some schools of obstetrics where section is performed in all cases without trial of labour. This is unsound, and those worthy of a trial must be separated from those which must be sectioned before labour starts. Also the cases must be divided into those seen antenatally and those which are not seen until labour starts. In the past we have advised following rules which we laid down according to the measurement of the pelvis: while pelvimetry is carried out, we do not rely on this method to anything like the same extent: we rely on watching the progress of labour and the progress of the foetal head through the birth canal.

In considering treatment, we used in the past to differentiate between the flattened pelvis and the generally contracted and flattened pelvis, but there is so little difference between the two, and other points to be explained are so much more important, that even this difference may be neglected. We shall now deal with those seen in pregnancy, and those which are first encountered in labour.

Treatment of contracted pelvis when encountered in pregnancy. Every patient should if possible be examined in pregnancy, and the diagnostic steps taken as described on p. 428. The question of induction of labour must be thought of with great care. We have no hesitation in recommending induction even in the case of primigravidae as a method of treatment.

If the woman be on her first confinement, and there is anything which suggests trouble, such as small measurements, over-full abdomen, etc., she should be further

examined. If the case is one of breech, it should be turned by external means to a head, so that a Müller estimation may be made: if a head presents, examination routine is carried out immediately. This follows pelvimetry. While the patient is under anaesthesia the internal measurements are taken with the Skutsch pelvimeter. If the head fits well into the pelvis at the thirty-fourth week, and the internal measurements are only slightly diminished, examine her again at the thirty-sixth week, which is the earliest date on which labour should be induced. If there is still plenty of room, examine her again every week until term. The first day on which the head fails to fit in is the day to induce labour. If the patient gets full antenatal care, these examinations can be done without anaesthesia until the time when active interference seems indicated, when an anaesthetic should be given.

If pelvimetry reveals that the true conjugate is 8 centimetres, or if the head does not fit with comfort, the case must be left to term, when Caesarean section should be done, with or without trial of labour. If the true conjugate is under 8 centimetres, the classical section should be done before labour starts. The operations of induction and Caesarean section are described in Chapter XXIII. If the woman has had previous confinements and there is no contra-indication to trial, labour should be induced after a careful Müller estimation.

Treatment when at or near full term or in labour. The first point to decide is whether *rules* can be made according to *measurement*, and whether *pelvimetry* gives us any information. The latter question is answered immediately in the affirmative, the former by stating below the rules that can certainly be laid down according to our present knowledge.

In our last edition we described the different degrees of contraction and gave rules according to these degrees. In the first class, the true conjugate was reduced to 9·75 centimetres. For this we advised that the patient should go to full term with a trial of labour—that in this trial certain complications might happen, but in most cases labour would progress satisfactorily. In the second class, when the true conjugate was 8·5 centimetres, we explained

our views on induction, pubiotomy, and Caesarean section. In the third class, when the true conjugate was reduced to 7·25 centimetres, we stated that premature children have been successfully born.

In this class pubiotomy and symphysiotomy are out of the question, and Caesarean section is the ideal treatment, with or without trial: the latter is to be preferred, and the lower segment is the site of choice for the incision. If, however, this patient is seen early, the classical Caesarean operation should be done when the baby is alive: if dead, craniotomy. In the fourth and fifth degrees (true conjugate 6 centimetres and below), Caesarean section must be done, whether the foetus be alive or dead.

If the case is straight and seen before labour starts, the classical section is done: if after a trial, the lower segment operation.

We have given the above ideas in brief, in order to satisfy examiners, but there are so many flaws in this teaching that we feel bound to reconsider our views. The greatest flaw of all is the fact that in estimating the true conjugate, the existence of the transverse diameter has been forgotten. Just as with a true conjugate of 8·5, and a transverse diameter of 13 centimetres, labour may progress without incident, so with a true conjugate of 9·5, and a transverse of 10–11 centimetres, labour may be difficult and prolonged and may end in Caesarean section or craniotomy. In other words, the head will find its way to the larger diameter of the pelvis when the smaller one is at fault. Pelvimetry has, however, the great advantage of giving us the information as to the capacity of the birth passages. We must not forget the existence of the funnel pelvis. We must remember that while outlet contraction alone is rare, it is a frequent accompaniment of general contraction, and that our pelvimetry which we have practised before we came to treatment will be an immense aid in carrying out treatment.

The measurement of the true conjugate gives us certain definite guides.

(1) If it is approximately normal and cannot be felt, the birth is not likely to be troublesome.

(2) If it is in the midway of extremes between normal and

marked diminution, the knowledge that the true conjugate is below 8 centimetres precludes pubiotomy.

(3) If the true conjugate is below 6 centimetres, birth by the vagina, even after craniotomy, is impossible, and Caesarean section is the choice.

In treating a case at or near full term, certain symptoms which are pathognomonic of disproportion may be present and must be sought for. These are :

(1) Ballotting of the presenting part. The head should have fixed three weeks before labour starts in a primipara, and it should not be freely mobile in a multipara.

(2) *Early rupture of the membranes.* This occurs because the presenting part does not fit the brim. Uterine contraction, instead of being directed evenly in all directions, presses down, tending to drive the " bag of waters " in a curved or *sausage-shaped manner.* Combined with this sign of contracted pelvis—

(3) Prolapse of the cord may occur because no presenting part fills the lower segment.

(4) For the same reason as mobility of the presenting part, *malpresentations* may be present.

(5) It is difficult to reach the presenting part with two fingers.

(6) The occurrence of a pendulous abdomen has already been referred to.

(7) The cervix in labour. Due to faulty retraction and non-filling of the cervix by the presenting part, the cervix hangs like a loose curtain quite freely in the vagina. The anterior lip may become oedematous and thickened. In addition, very slow dilatation may occur, although the pains are good.

We have now got to decide whether to give our patient a trial of labour.

All our facts are before us.

Generally speaking, except where the true conjugate is under 8 centimetres, and where the other diameters are lessened in proportion, we give a trial of labour. In the former cases we do Caesarean section immediately.

Even when the true conjugate is larger many people per-

form Caesarean section before labour starts, when, if patience had been exercised, a normal spontaneous birth would have occurred.

Comparison between immediate section and a trial of labour. If there is no infection, section is safe: it nearly always means a live mother and child, but it means a number of unnecessary operations, and it means as a rule —once a Caesarean, always a Caesarean. In addition the morbidity and mortality rates are far greater with Caesarean section than when delivery takes place by the vagina.

In a trial of labour there is every chance of a live mother and a live child delivered by the vagina. There may be a little more manipulation, but if the trial is conducted properly, there should be but little manipulation. It has been proved that the bacterial content of the uterus is increased, and that the risk of sepsis is increased the longer labour lasts after rupture of the membranes, but we do not hold that this is a contra-indication.

If every sign is noted, the result to mother and child should be good. If trial is not proving satisfactory, the labour can be terminated with safety at any time. In fact there is no valid objection to a trial of labour in a suitable case.

Indications for, and special points to remember during a trial of labour. An effort has been made to make clear the instances in which a trial is not advised, *i.e.* when section should be done before labour. They are:

(1) When the pelvis is very small (see p. 463).

(2) When, after a Müller estimation, it is obvious that the misfit is too great to allow vaginal delivery. (The method of ascertaining this has been described on p. 446.)

But the woman has now been examined thoroughly, and a trial has been decided on.

The main features in this are:

(1) To know when the patient is in inertia, for she can get over this when it is not due to the disproportion.

(2) To make as few vaginal examinations as possible.

(3) To try to recognise the time when the uterus has done all it can, and when interference is necessary.

(4) In conjunction with this, to watch the foetal heart rate

and to decide whether changes in this rate are danger signs to the foetus.

(5) To note the temperature and pulse records of the mother, and to decide, by comparing them with other factors in the labour, whether rises in these rates spell danger.

(6) To remember especially that the danger is greater to the foetus once the membranes have ruptured, but that no definite period of time can be laid down after rupture as a necessary indication for interference.

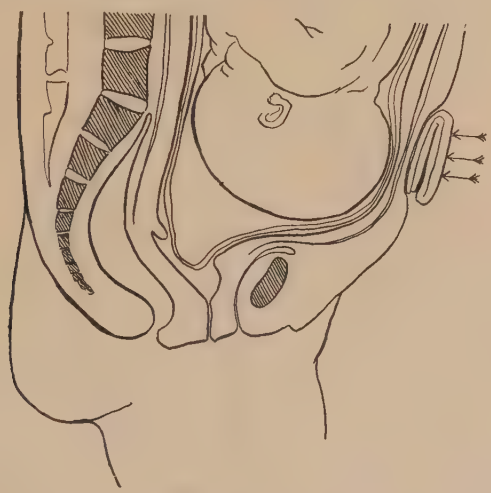


Fig. 221.—Solomons' method for assisting in cases of disproportion.

(7) That preparations for abdominal section should be made, to obviate delay when delivery is indicated.

(8) That morphine and the Walcher position are useful.

The trial of labour. The patient is seen at the commencement of labour: it has been decided that she is a "ball line" case, and that section or pubiotomy may be necessary.

Malpresentations have been excluded or corrected. Sedatives should be given at night: they may be given with comparative safety so long as the membranes are unruptured: they must be given with absolute caution once the membranes have ruptured. The head is firmly in the brim: it is not engaged. At night she is given morphine gr. $\frac{1}{4}$. In the day-time the pad and binder are applied (see Figs. 221, 222). These should be left in position during sleep, for

labour proceeds all this time. If the uterus becomes sluggish, quinine grs. 5 may be given. Hot vaginal douches and hot enemas will also help. The bowels and bladder must be kept free. Labour goes on slowly: its progress is noted by the level of retraction together with rectal examination. The method of estimating the size of the cervix by the level of retraction is of assistance in some cases, but cannot be relied on as an absolute indication of the size of the external os: it is really more correct to say it is an indication of the tension of the lower uterine segment. While not always an indication, however, of the size of the cervix, it may be so,

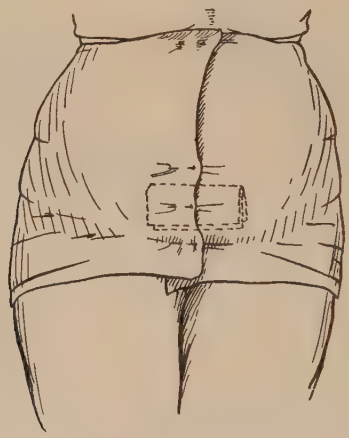


Fig. 222.—Solomons' method for assisting in cases of disproportion.

and a marked difference between the two when taken in conjunction with the other symptoms will certainly help in the diagnosis and treatment of disproportion.

When it indicates the size of the cervix in a normal case with normal rate of dilatation and uterine action, a three-finger os should be three fingers above the pubis. If these two do not correspond, it means in many instances that there is some obstruction, and if, *e.g.*, the retraction level is at the umbilicus and the size of the cervix as felt by rectal examination is two fingers, obstruction may be suspected. If this size is combined with a loose, flapping, oedematous cervix, empty, with the presenting part above it, the outlook for vaginal delivery is serious.

So long as the membranes are unruptured, all is well. When the membranes rupture, a careful rectal examination is made, and if this does not convey all the necessary information, *the first*, and *probably the only vaginal examination* is made. We wish to stress this point very much, viz. the necessity for avoiding vaginal examination. When it is made now, the first thing to be done is to exclude prolapse of the cord. The size of the cervix and its relation to retraction level are determined. Whether it is filled with the presenting part, or flapping, is determined, *i.e.* the cervix is empty with the head above it. The height of the presenting part must be ascertained. Immediately after rupture of the membranes, neither moulding nor caput succedaneum will be present, but these points must be looked for as labour progresses. Excessive moulding and increase in the size of the caput are warning symptoms previous to the passing of solid meconium, and very quick or slow foetal heart rate forewarns the death of the child. So long as the foetus shows no stress there is no danger, but a large caput, moulding, etc. will give the clue to necessity for delivery.

It must be discovered in what strait the head is and whether it is fixed. In addition to examination, a Müller estimation under anaesthesia should be done at this stage, when it will be determined whether vaginal delivery will be possible or not. If it is decided that it is possible, it is unnecessary to do anything, and the labour may progress until the head is on the perineum, when natural delivery will occur or delivery by forceps may be done.

The intermediate stages must be noted by abdominal and rectal examination; special note can also be made by practising the author's modification of the Müller grip: if necessary (under extreme stress of circumstance) another vaginal examination may be made. The labour is carried on if there is no indication for delivery, and the progress can be noted, especially by (1) rectal examination during a pain to decide on progress; (2) the presence or absence of such signs as moulding and caput formation.

The Walcher position must always be remembered. We advise the Walcher position as a magnificent help in the treatment of contracted pelvis. While it is of most use

when the patient is having labour pains, it is of use also when the pains are slight, for it often allows the head to descend to the cervix to stimulate the ganglia and to induce more efficient labour.

In the Walcher position (see Fig. 223) the patient lies on her back, with her hips projecting over the edge of the bed, and her legs and thighs hanging down by their own weight. The feet must not touch the ground, or this extension will not occur. Sometimes the bed is not high enough. If so,

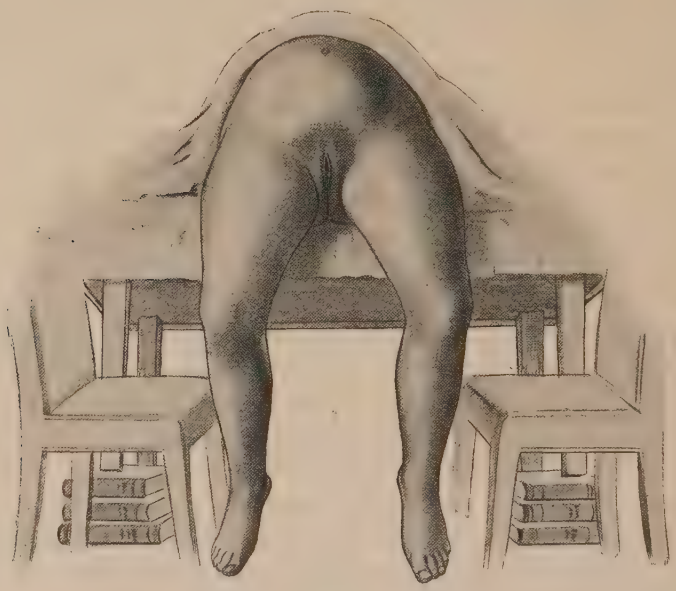


Fig. 223.—Walcher's position.

raise it by putting blocks or big books under the side legs. Walcher's position is painful to maintain, therefore arrange for the patient to rest her feet on chairs between the pains, and when the pains come on, tell her to let her legs hang down. She can lie for hours in this position covered by blankets: she should alternate half-hour rests with half-hours in the Walcher position. The weight of the lower limbs rotates the pelvis on the sacro-iliac joints, so that the pubic bone sinks. In this way the true conjugate is actually lengthened by about 1 centimetre, and this addition is of the greatest value.

It must be remembered that this position is only of value in the brim. When the head comes to the outlet the Walcher position actually diminishes this measurement.

As labour progresses, press the head down into the brim, and put on a tight binder and pad (see Figs. 221, 222). This is of enormous benefit, and brings an unfixed head into the axis of the superior strait.

The temperature and pulse-rates are noted at half-hour intervals, the foetal heart even more often.

The relation of the retraction level to the size and condition at the cervix must be noted. As stated already, there is no need for any further vaginal examination unless there is definite doubt as to the condition of affairs.

The important question to decide is, *When should the trial be terminated?*

So long as the progress of labour is maintained, so long is the danger absent. Immediately there is a deadlock, inquiry must be made to decide if the labour should be terminated. This deadlock may come with the cervix fully dilated or not. A curious fallacy may upset the judgment of the obstetrician. Extreme moulding with marked flexion may bring the head down to the perineum. Always do Pawlik's grip in these cases, and ascertain if there is still some part of the head above the brim: otherwise the unwary will be caught. It is well to remember that a little head above the brim on palpation without anaesthesia often means a great deal when the patient is anaesthetised. We have tried tentative forceps in this class of case, and have ended with pubiotomy. Generally speaking it is incorrect to apply forceps when the head is above the brim.

How can the end of the trial be decided?

(1) There is no appreciable descent of the presenting part as felt by the abdomen.

(2) There is no appreciable descent as felt by the rectum during a pain.

(3) The temperature and pulse-rates as well as the foetal heart rate all show danger signals, thus demonstrating that

the uterus is working against obstruction, and that both mother and child are in danger.

In addition to these three signs, moulding is marked and the retraction level is at the umbilicus, while the cervix is half dilated when it should be full.

What should be done ? If the cervix is fully dilated, tentative forceps should be applied, *i.e.* forceps should be applied to the head, and gentle traction should be made with the patient in the Walcher position : if the bony obstruction is evident, the operator must desist, and the pubic bone is cut with the pubiotomy saw, which is ready.

We still use Barnes's forceps with Neville's axis tractor : we have tried the Kielland forceps, but we do not favour either them or any similar instrument, such as that of Barton. They favour too greatly meddlesome midwifery, but they will be considered later.

If the cervix is not dilated fully. With the retraction level at the umbilicus or above it, the lower segment is under great tension, and obstruction is probable : there is only one thing to do in the present day—the low segment Caesarean section. This is an ideal operation in this type of case.

Needless to add, if the child be dead, craniotomy must be done.

A trial where the presentation is breech. A trial of labour should be done with the head presenting : occasionally, however, labour advances so that the breech cannot be changed. Allow the labour to progress until the breech is through the superior strait. It must then be determined whether the head will mould through. Generally speaking, this will occur, and a very good idea can be obtained by examination of the limbs, by vagina ; this will assist the obstetrician in deciding as to the size of the head. In addition the ease with which the breech comes through gives a fair indication for prognosis for delivery of the head. If, however, it does not appear as if the breech will come through the brim, the outlook for delivery is extremely poor. Danger signs must be looked for, and delivery by section accomplished when indicated, according to the rules already laid down.

To sum up the essentials of a trial of labour, especially with regard to prognosis.

1. Decide carefully, according to the principles enumerated, whether a trial is justified.

2. *Do not carry it on too long.* When Bandl's ring is high, near the umbilicus, and the cervix is not dilated: when this sign is combined with non-descent as demonstrated by palpating the presenting part by rectum during a pain and by abdominal palpation: when the foetal heart rate is irregular, too fast, too slow, or of weak consistence: when the temperature and pulse rate have risen: a combination of all these tell us to end the trial. Other factors are the passing of solid meconium in head presentations, maternal distress, etc.

3. There is no necessity, as a rule, to make more than one vaginal examination.

4. A Kerr-Müller estimation during labour with anaesthesia is extremely useful.

5. There are very rare instances where there is no marked disproportion, but where inertia is marked. In these cases birth does not occur sometimes until many hours after rupture of the membranes. If there are definite foetal indications, it may be necessary to apply forceps before the cervix is quite fully open. It must be clearly understood that this is a rare type of case, that the cervix will be torn, that some traumatic haemorrhage may result, and that the trouble is inertia—not disproportion.

6. In estimating whether a head will come through the pelvis or not, all factors must be taken into consideration. A small true conjugate does not mean a bad prognosis for delivery, if the other diameters of the inlet and the outlet are normal. In other words, the head will find its way into the largest diameter, and will come through in the transverse in a flattened pelvis in the same way as it will probably come through the antero-posterior or the oblique in a generally contracted pelvis.

Dangers of contracted pelvis. Apart from the dangers already enumerated, *e.g.* abnormalities in dilatation, uterine inertia, danger to the foetus from malpresentation, moulding, cerebral haemorrhage, depressed fracture of the skull,

such conditions as death from sepsis following on increased manipulations may occur. Rupture of the uterus following malpresentation, manipulations or attrition of the foetus against the promontory may be sequelae of contracted pelvis. It must be borne in mind especially that the danger to the child is greater once the membranes have ruptured.

Finally, ruptured pelvic bones or joints have been reported.

Future pregnancies. Any woman who has had a contracted pelvis must be warned to attend a doctor early in her next pregnancy. He will then have determined whether it will be better to induce labour, or to perform Caesarean section at term.

SYNOPSIS OF TREATMENT OF DIFFICULT DELIVERY

1. Ascertain whether the patient is a primigravida or a multipara. If a primigravida, remember that Nature expects every woman to deliver herself; if a multipara, inquire into the history of her previous labours. If she has been normally delivered of one live child there cannot be any great degree of contracted pelvis.

2. Diagnose by palpation and, if necessary, vaginal examination, the presence or absence of labour, and whether the membranes are intact or have ruptured. Intact membranes are synchronous with safety of the mother and foetus.

3. Determine, on vaginal examination, the presence or absence of moulding and caput if the membranes are ruptured; note the level of the lowest portion of the head in the pelvis, the dilatation of the cervix and its application to the presenting part; also note if any advance is made with a pain. If this is unsatisfactory, examine under an anaesthetic, and, using the outside hand to grasp the portion of head which is above the brim, try to move bimanually the head up and down in the brim. By this means bony obstruction will be discovered, if it is present.

4. If the patient is in labour the signs of danger by external examination are: a tense uterus between the pains, a high retraction level, a presenting part which is about two to four finger-breadths above the symphysis and will not pass

into the brim with firm pressure; in addition a sausage-shaped bag of membranes which bulges with the pains, a cervix which is empty and hangs down, a running pulse, and the cardinal signs of foetal distress are sufficient to indicate that delivery is the only line of treatment.

When these signs are present, it is essential in a primigravida, or in a woman who has had difficult labours and still-born children, to find out if there is any contraction of the pelvis and the degree.

A full examination, including pelvimetry and an estimation of the relative size of the head and the pelvis, is made by Müller's method, and the appropriate treatment decided on.

Remember especially that contraction of the pelvis is not always the cause of dystocia, and that malpresentations of the foetus and the other well-known causes must be borne in mind.

CHAPTER XX

ABNORMALITIES OF THE THIRD STAGE

Post-partum Haemorrhage, including Retained and Adherent Placenta and Traumatic Conditions—Inversion of the Uterus—Sudden or Rapid Death.

POST-PARTUM HAEMORRHAGE

THERE is no condition in obstetrics which more requires a clear head, no excitement and the experience necessary to decide if the treatment is to be on palliative or radical lines. This decision is all-important, and the young practitioner will often be drastic and perform manipulations when the older and wiser man may temporise; but even temporising may be too long persisted in, and trouble then will be bound to occur.

An effort has been made to define this abnormality. It has been suggested that post-partum haemorrhage might be so called according to the amount of blood lost, some suggesting one pint, others two pints. We consider this just as unpractical as endeavouring to adopt the nomenclature according to the degree of anaemia after an examination of the blood. It is best to define post-partum haemorrhage as a condition when constitutional symptoms have arisen or seem likely to arise, from the amount of blood lost. That is, some women show symptoms after a very small loss, other women after a great loss.

Causes. These may be found arising in pregnancy, labour, and the puerperium. In considering these various periods of pregnancy as causal factors in post-partum haemorrhage, *the natural means by which haemorrhage is prevented* must be mentioned.

The placenta forms, as it were, the inner wall to the placental area, where the uterus is riddled with large blood

vessels and sinuses, which are exposed by the peeling off of the placenta. There are three ways by which the bleeding is stopped naturally :

1. By contraction of the uterus.
2. By retraction of the uterus.
3. By clotting of blood.

The corkscrew twist of the uterine arteries and V-shaped bend of the uterine veins also add to the efficiency of contraction and retraction.

Nature and importance of retraction. Retraction is a function of uterine muscle quite distinct from contraction. We can be sure that this is so, for when in Caesarean section we come to stitch up the uterus, we notice that the muscle wall thickens, although it may remain flabby. Moreover, when this thickening of the wall occurs, bleeding from the cut uterine wall either lessens or ceases altogether.

Contraction is a temporary diminution in the length of the muscle fibres. Retraction is a permanent diminution in the length of muscle fibres. Before rupture of the membranes, retraction can only occur by the formation of the lower uterine segment, and by the dilatation of the internal os. After delivery, the cavity of the uterus is permanently diminished in size by retraction, and in a normal case there is little, and sometimes no haemorrhage; it is this peculiar quality of the uterine muscle, the power of continued retraction rather than intermittent contraction, that stops haemorrhage. Therefore cases sometimes occur in which the uterus fails to contract and harden as one would wish, and yet there is no bleeding. In these cases retraction, a quality independent of contraction, stops the bleeding.

A hard contracting uterus, however, signifies a uterus in which both contraction and retraction are efficient. When, therefore, the hand is placed on the uterus, after the birth of the placenta, and it is found hard and contracted, and it remains firm, then bleeding cannot occur from the placental site.

1. **Causes of post-partum haemorrhage in Pregnancy.** Anything which tends to uterine inertia, *e.g.* tumours of the uterus and ovary, a flabby abdomen with

diastasis of the recti muscles, pendulous belly. The treatment of these conditions has already been described.

2. **Causes of post-partum haemorrhage in Labour.** Herein will be found the chief causes of post-partum haemorrhage, and the aetiological factors may be discovered during the first, second, or third stage. In the first and second stages, uterine inertia is the predominant factor: this may be caused by such diverse conditions as tumours, pendulous belly, weakness of the abdominal muscles, hydramnios, multiple pregnancy, full bladder, and malpresentation of the child: these and other abnormalities must be dealt with, but the main fact to remember is that, as they may cause post-partum haemorrhage, the practitioner must be in readiness for this eventuality in cases where inertia, either primary or secondary, has occurred. Above all, it must be mentioned that any attempt to deliver before conditions are fulfilled is one of the fruitful factors in the causation of post-partum haemorrhage.

The third stage of labour is the one which is most commonly associated with post-partum haemorrhage, and its main causes will be described later. Impatience during the third stage of labour, *i.e.* attempts at delivery before the placenta has left the uterus, and irritation of the uterus by controlling it incorrectly, are fruitful causes of post-partum haemorrhage.

The treatment will depend on whether the bleeding is *traumatic* or *atonic*, and a differential diagnosis must be made in most instances. There are occasions, however, when the bleeding is so rapid that there is no time to make the diagnosis, and in that case the treatment must be carried out irrespective of the diagnosis.

3. **Causes of post-partum haemorrhage in the Puerperium.** These are extremely rare, and are due either to secondary haemorrhage from a stitched perineum, or else to retained secundines (membrane or placenta). In the case of the former, restitching must be carried out. When the latter occurs, routine treatment is adopted. Post-partum haemorrhage is rare two or three hours after the placenta is born, but it has occurred on the fifth day of the puerperium in our practice.

Varieties of Post-partum Haemorrhage

Traumatic.

The Perineum is torn in nearly all first labours, but while haemorrhage to any extent is unusual, a spurting vessel is seen in some instances. When present, the perineum should be stitched as described on p. 170. *A haematoma* may form in the region of the perineum, and may be due to actual injury of a vessel during the labour: it may be caused by puncture of a vein with a needle when suturing. When the haematoma is increasing, the clot must be turned out and the bleeding point tied with catgut, or else the cavity may be plugged with iodoform gauze, which is removed

Fig. 224.—Sewing the base of the clitoris, showing introduction of needle. (From the author's *Handbook of Gynaecology*.)

after twenty-four hours. If, on the contrary, it is small and not increasing, it may be left alone.

If the haematoma suppurates, it is treated as an abscess. In the rare cases where a haematoma is met with before labour, leave alone if it is unlikely to cause dystocia. If, however, it obstructs delivery by its size, incise, and tie bleeding points or plug as indicated.

The **Clitoris** may be injured during labour and severe haemorrhage may result: this arises from the base and is treated by stitching with Number 4 catgut, using a small cervix needle which is passed down as far as the bone (see Figs. 224 and 225).

The Vagina may be torn in difficult labours, the most common of these being persistent occipito-posterior presentation. The likelihood of vaginal tears in the operation of pubiotomy must also be remembered. These tears

occasionally cause haemorrhage, which is controlled as a rule by a hot vaginal douche given at a temperature of 116 to 118° F.: if this does not suffice to stop bleeding, the tear should be stitched with continuous catgut loaded on a small cervix needle. Care must be taken to pass the sutures deeply, as they are likely to tear out, as the vaginal wall is soft and friable.

The Cervix. The question which arises under this heading is: Should all torn cervices be stitched, whether they bleed or not? In our examination of 569 primigravidae (normal deliveries) three weeks after labour, it

Fig. 225.—Sewing the base of the clitoris, showing that the needle must be entered to the bone. (From the author's *Handbook of Gynaecology*.)

was found that over 60 per cent. had lacerated cervix of some degree. This, therefore, suggests that stitching should be done as a routine: the manipulation necessary for this is so great that we advise against the routine examination of the cervix after delivery. If, however, some manipulation has been carried out and there is every likelihood of the cervix being torn, or if it prolapses down to the vulva after delivery, and the condition is obvious, then suturing should be done. If haemorrhage is present, the ideal treatment is to suture. If stitching material is not to hand, or the patient has collapsed, the effect of a hot vaginal douche at a temperature of 116 to 118° F., followed by plugging with iodoform gauze six inches wide, should be performed.

How to stitch a torn cervix (see Fig. 226). Even if the cervical lips be oedematous, suturing is possible. Get an assistant to press down the fundus from the abdomen, pass two fingers up to the cervix and pass by touch up to the upper limit of the tear a cervix needle loaded with catgut on a long needle-holder. This first stitch acts as a tractor, and the remainder of the tear is sewn by means of interrupted sutures.

This is the ideal method: the alternative is to draw the cervix down by ring forceps or *very sharp* bullet forceps.

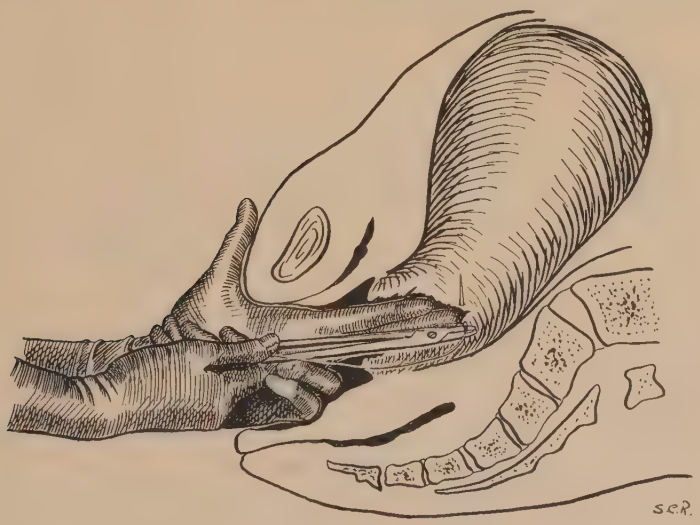


Fig. 226.—Stitching cervical laceration by touch.

The latter, even when sharp, are unsatisfactory and tend to tear out, and the former are inclined to traumatise the cervix.

The differential diagnosis of traumatic and atonic haemorrhage. It may be extremely difficult to make this diagnosis in some cases, but there are certain cardinal symptoms and signs, and the history, whether of inertia or of trauma, may be obtained. Bleeding from the placental site is more common than severe bleeding from a laceration.

In the atonic variety the uterus is soft, large and flabby. There is complete absence of contraction, and retraction is slow. When it contracts, either spontaneously or when it

is rubbed up, blood and blood clots are expelled and the haemorrhage ceases while the uterus refills, *i.e.* atonic haemorrhage is intermittent.

In the traumatic variety the uterus is probably hard and retracted, not increased in size; there is a continuous flow of blood, which, although continuous, may issue in spurts.

As already stated, these rules should not be interpreted too strictly, for a contracting uterus diminishes to some extent the flow of blood from the cervix.

The following table shows how to diagnose atonic or placental site haemorrhage from traumatic haemorrhage.

	Atonic.	*Traumatic.*
Cause.	Inertia from some cause in pregnancy or labour, *e.g.* over-distension, retained placenta, etc.	Trauma.
Uterus.	Large, soft and flabby.	Hard.
Blood.	In gushes.	Continuously and in spurts.
Site of haem.	Cannot be seen.	Visible.

Atonic post-partum haemorrhage. Before proceeding with the further consideration of this condition, one of the most common causes for its occurrence must be considered, viz. retained placenta. This may be a *simple retention*, or the placenta may be *morbidly adherent*. The method by which the placenta separates from the uterus and is expelled into the vagina, together with the signs which show it has been expelled into the vagina, have been already given under the management of normal labour. As we said there, we base our practice on the belief that the placenta is separated by a retro-placental haematoma. Rubbing or squeezing the uterus before the placenta has left it is distinctly harmful for two reasons: (1) It may squeeze out the retro-placental haematoma which is separating the placenta from the uterine wall; (2) it is a cause of irregular contraction of the uterus, which does not separate and expel the placenta as efficiently as when the uterus is left to contract by itself.

Frequency of manual removal of the placenta. The attendant should remember that this operation is fraught

with danger to the patient, that it is attended by a high rate of morbidity, and that the mortality following the operation is considerable. Therefore extreme and great care must be exerted to avoid the necessity for interference.

In a group of statistics at the Rotunda Hospital the placenta was removed manually 141 times in 14,168 cases, or one in a hundred.

Retention without morbid adherence. This may be due to various causes.

(1) When chloroform has been given, expulsion may be delayed: this applies particularly when it has been given for a long time.

(2) The feeble uterus of inertia takes a long time to expel the placenta.

(3) Manipulation too soon after the birth of the baby and before it has left the uterus, thus causing expulsion of the retro-placental haematoma, leads to retention, *i.e.* incomplete separation.

(4) Irregular uterine contractions due to injudicious kneading of the uterus, to the administration of ergot, pituitary extract or similar drugs, to a full bladder, or to some unknown cause, may cause retention of the placenta.

(5) Hour-glass contractions. This may be due to manipulation as mentioned above, or it may be a recurrence of a contraction ring which was present before the birth of the baby.

Haemorrhage may be associated with this, or there may be no haemorrhage. It constitutes by far the most usual cause of retained placenta, and, as mentioned already, the greatest care must be exercised if the fundus be controlled, and no effort should be made to express the placenta until it has left the uterus.

It can sometimes be diagnosed by the presence of a definite constriction which may be seen across the abdomen: in other cases it can only be diagnosed by surmise, *i.e.* it has not left the uterus and there is no discoverable cause.

The treatment is: (1) If the fundus has been controlled, remove the hand and leave the uterus absolutely alone: if there is no haemorrhage, nothing need be done for at least half an hour.

(2) Give the patient morphine gr. $\frac{1}{4}$.

(3) If this is unsuccessful, give her a few whiffs of chloroform, and try to express the placenta.

(4) If this is unsuccessful and the patient is bleeding or collapsed, the placenta must be removed manually.

It is safe to wait for two hours in a case of hour-glass contraction unless symptoms demand interference earlier, but it is unusual to have to wait so long as this.

The morbidly adherent placenta. The cause of this condition is not actually known: it is due probably to some inflammatory condition in the decidua or even to disease in the placenta itself.

Syphilis is present in some cases, and the amount of adherence varies from—(1) Slightly adherent membrane to (2) some slight degree of adhesion of the placenta; (3) nearly complete adhesion of the placenta; (4) placenta accreta. The last has already been dealt with.

Diagnosis. It is sometimes impossible to know whether the placenta is morbidly adherent or simply retained until symptoms necessitate its removal. In most cases if it is impossible to express the placenta after an hour, whether bleeding is present or not, it is likely to be adherent.

Treatment. If there is bleeding which is in excess of the normal and affects the patient, or if it is a case of morbid adhesion of the placenta, it must be removed.

In an ordinary case, in which there is no alarming haemorrhage and the pulse is steady, let the patient alone for one hour unless the pulse-rate is rising, or there are other signs of the onset of shock. After an hour shock is liable to occur even in the absence of haemorrhage. If it is decided to express the placenta rub up the uterus until it contracts well, and then squeeze it as one would a lemon. If this fails wait for another pain and repeat. Stretch the cord at the same time to see if it lengthens. If this method fails further treatment depends on the condition of the patient and whether her uterus is the feeble one of inertia, is in hour-glass contraction, or has been rendered sluggish by chloroform; in which case wait a longer or shorter time and try again. Manual removal may have to be undertaken eventually.

The causes of atonic post-partum haemorrhage. We have dealt with the causes of haemorrhage generally, and the causes of haemorrhage from the placental site must now be dealt with.

Causes of post-partum haemorrhage from the placental site.

1. Inherent inefficiency of the uterine muscle. This is rare. Even after primary uterine inertia, the retraction may be strong enough to prevent excessive haemorrhage although contraction is very feeble. Haemorrhage due to this cause is known as *atonic haemorrhage.*

2. Anything within the uterus, namely, the whole or part of the placenta, membranes, or a large blood clot, interferes with retraction and contraction. *This is by far the commonest cause of post-partum haemorrhage.*

3. A tumour in the wall of the uterus, or a full bladder, interferes with contraction, and more especially retraction. *Full bladder must always be remembered as a cause of bleeding.* It is a simple cause, readily remedied, yet frequently overlooked. Haemorrhage due to the last two causes is called *pseudo-atonic haemorrhage.*

4. General diseases, such as haemophilia, Bright's disease, and the toxaemias of pregnancy, which are characterised by a tendency to cause free bleeding.

5. The use of acids and acid drinks, particularly those containing citric acid, tend to cause haemorrhage, both ante- and post-partum.

Signs and symptoms. A certain amount of haemorrhage accompanies the third stage always. The average is said to be under a pint. The haemorrhage is called post-partum haemorrhage when the loss of blood causes constitutional symptoms in the patient.

Treatment. The first principle in treatment is prevention and readiness. In case of uterine inertia in labour, caused by any condition, the doctor must be in readiness to treat post-partum haemorrhage: also ante-partum haemorrhage will predispose to its occurrence.

The treatment will depend on whether the placenta has been delivered or not.

1. **The placenta has not been delivered.** In these cases the treatment is clear, namely, to pass a catheter, to rub up the uterus, and to express the placenta. If the latter fails, it must be removed manually. If the blood comes in a large gush, the abdominal aorta must be compressed and the uterus acutely anteflexed over the pubes while preparations are made to remove the placenta manually. In the case of a sudden and severe outpouring of blood, it is necessary to stop the haemorrhage promptly, or the patient will die. A knowledge of this fact emphasises the necessity for having everything sterilised in readiness to treat post-partum haemorrhage.

If possible in all cases an assistant should give saline solution under the breasts while the operator is treating the haemorrhage. This is used as a prophylactic routine at the Rotunda, and has saved many lives. It is given at a temperature of about 103° F. so that it gets into the heart about blood heat. It is poured in from a jug which is kept in a basin of hot water when not in use (p. 299). Ordinary boiled salt may be used, but ʒi tablets of sodium chloride, which can be purchased, are convenient to carry.

2. **The placenta has been delivered.** If the case is one of extreme urgency, the placenta and membranes should be immediately examined to exclude retention of a cotyledon, etc.: if not, the following routine is followed. The uterus is rubbed up to remove all clots and membranes, femergin or ernutin 1 c.c. is given hypodermically, also pituitrin 1 c.c., the uterus is well anteflexed over the pubes.

If the douche can, etc., have not been prepared, they are got ready. The patient is put in the cross-bed position and a sterile towel is placed over the abdomen. If the operator is not wearing a sterile coat, gauntlets should be worn, as the arm must be inserted into the uterus.

Manual removal of the after-birth.

Anaesthesia. The administration of an anaesthetic depends largely on the patient. On most occasions an anaesthetic is advisable.

Preparations. The aseptic precautions for manual removal of the placenta must be thorough. There is no

rush of liquor amnii to flush away any bacteria that may be carried into the uterus. Again, the area where septic organisms are most likely to be implanted, namely, the placental area, is the site of operation. Therefore get the patient into the cross-bed position. Having disinfected the hands and put on gloves, wash the external genitals thoroughly with soap and water, pass a catheter, and give a vaginal douche. Lubricate one hand with soap and pass it in a cone shape up into the uterus.

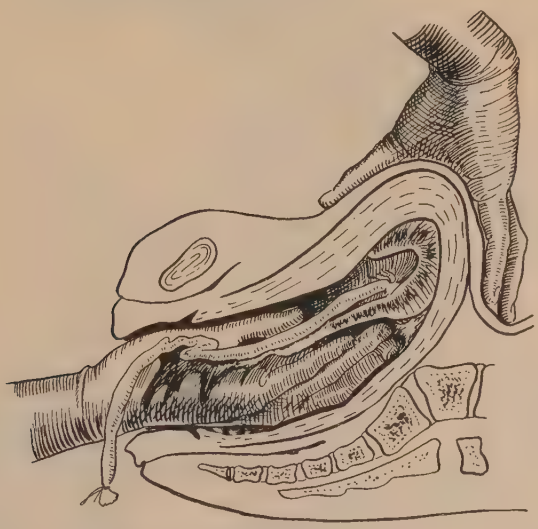


Fig. 227.—Bimanual removal of placenta.

Removal (Fig. 227). The first difficulty that may be encountered is hour-glass contraction. This can be overcome by steady pressure with the fingers and counter pressure by the other hand on the abdomen; *the latter is most important.* Then separate the after-birth. To do this, get the fingers between the membranes and the uterine wall, and by keeping along the uterine wall sweep the fingers to and fro around the whole uterus between the after-birth and uterine wall. Work from below upwards if the placenta is on the posterior wall, and from above downwards if it is on the anterior wall. Catch the placenta and pull it away. If it comes away entire in this way, be content, but examine the after-birth carefully to see that it really is entire.

The operator must insert his hand into the uterus until he is absolutely certain it is clear. No placenta or membrane must be left to serve as a nidus for infection. Although the hand is reinserted into the uterus there is no need to withdraw it from the vagina. There will be less manipulation if this method is adopted.

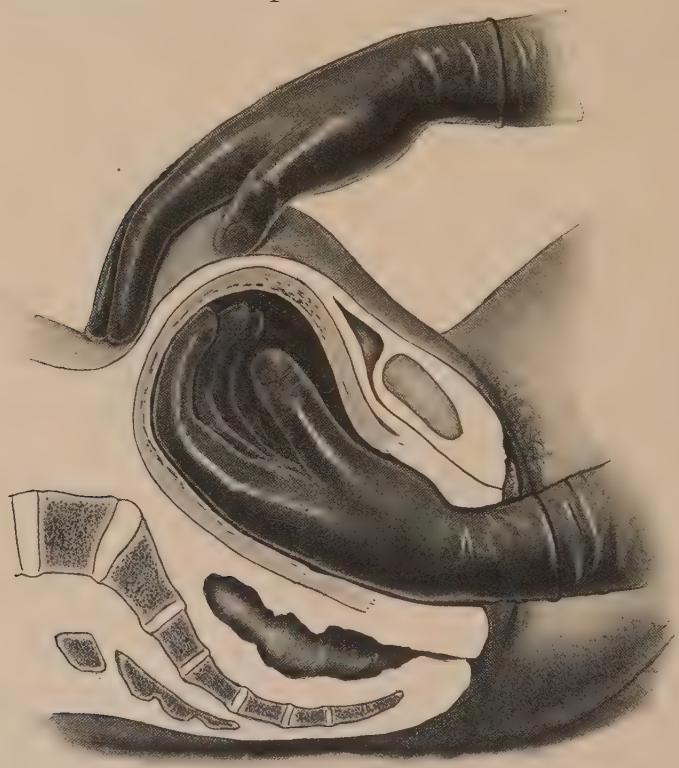


Fig. 228.—Bimanual kneading of the uterus.

Whether the bleeding has ceased or not, give a hot intra-uterine douche which is at a temperature of 116–118° F., or as hot as the back of the arm will bear.

If the bleeding still persists and it is certain that the inside of the uterus is clear, pass the hand in again and knead the uterus (see Fig. 228). The knuckles of one hand inside the uterus against the palm of the other abdomen is most effective. Another intra-uterine douche is then given, and if this fails to stop the haemorrhage, the uterus must be

plugged. Iodoform gauze six inches wide should be carried for this purpose.

Of the many methods in vogue, the two following are recommended:

(*a*) The cervix is caught (two ring forceps one on each lip), a posterior speculum is passed, and the uterus is plugged by means of a plugging forceps. If there is only one assistant he or she should hold the jar of gauze in one hand and

Fig. 229.—Uterus packed incorrectly for post-partum haemorrhage, showing collection of blood above gauze. (After De Lee.)

the ring forceps in the other, while the operator should hold the plugging forceps in one hand and control the fundus with the other: it is *impossible to plug in a proper manner without controlling the fundus*, for if control is not carried out blood will collect above the gauze as shown in Fig. 229.

(*b*) The half hand is placed in the vagina and acts as a posterior speculum, and the uterus is plugged by passing the gauze up as already described. The special differences in this case are: the cervix is not pulled down, the operator acts as described, the assistant holds the jar of gauze and

controls the fundus. When the uterus is plugged, gauze should be placed around the fornices and a tight binder applied. If haemorrhage continues after this, the uterus is not plugged properly and it should be plugged again. The gauze is removed in six hours.

Other methods of stopping severe post-partum haemorrhage. (1) Severe bleeding can be stopped by direct pressure on the aorta from the abdomen. We have used this pressure in urgent cases, until other expedients were available.

(2) Another method of stopping urgent bleeding is by bimanual compression of the uterus between one hand in the anterior fornix while the other on the abdomen antiflexes the uterus near the pubes.

(3) Pull the fundus of the uterus over the pubes, and keep it acutely anteflexed. This will usually stop bleeding. It is a good way to gain time to prepare for other measures, but it causes some discomfort to the patient.

After the bleeding has been controlled, collapse must be countered. The measures for doing this have been described on p. 296. It must be borne in mind that even when collapse has been overcome, the patient must be carefully watched for signs of secondary collapse.

Summary of the Treatment of Post-partum Haemorrhage. In a case where it has been found impossible to express the placenta, compress the abdominal aorta or anteflex the uterus over the pubes while the douche is being prepared.

Give submammary saline, raise the foot of the bed.

When the douche is ready, having prepared the patient—

(1) Remove the placenta bimanually.

If she continues to bleed—

(2) Pass the hand up again and remove any clots or membrane.

(3) Give a hot intra-uterine douche at a temperature of 116—118° F.

(4) Knead the uterus bimanually.

(5) Give a hot intra-uterine douche.

(6) Plug the uterus with iodoform gauze.

(7) Treat collapse.

Once the placenta is away, give femergin or ernutin 1 c.c. and pituitrin 1 c.c.

Watch the patient carefully for symptoms of secondary collapse.

Remember above all to keep the patient warm, and give her fluids by mouth, rectum, submammary or intravenously.

Complications which may follow post-partum haemorrhage. Sepsis is the greatest danger. It may arise either as the result of manipulations or from the diminished resisting power of the patient. Some type of serum should be given in all cases after intra-uterine manipulations. We use as a routine either 20 c.c. of antistreptococcus serum or of collosal iodine.

Anaemia is another common complication, and haemoglobin grs. 5 three times a day should be administered: if necessary, transfusion of blood should be done. The patient should be treated for the condition for six weeks, and should be told not to become pregnant again until pronounced fit by her physician.

INVERSION OF THE UTERUS

The sudden turning inside out of the uterus is extremely rare.

Causes. It is known to have followed pulling on the cord, pressure on the fundus, and is said to have followed precipitate labour. It may occur without any obvious reason. According to Atthill, the uterus must be in a partially atonic condition, and the placenta situated on the fundus. We believe that it may occur spontaneously; it has been found in a very thin-walled uterus with fundal insertion of the placenta. It arises from irregular contractions which affect the fundus while the body of the uterus remains atonic.

Result. Great shock, which remains as long as the uterus is inverted, and is quite independent of haemorrhage. Occasionally, shock is entirely absent, but sometimes it is so great as to cause death.

Diagnosis. Because of the sudden conditions of shock an examination is made. On palpating the abdomen, either

the uterus has disappeared, or the fundus has dipped down, like a cup. Sometimes the uterus appears when the lips of the vulva are opened, or it may even come out through the vulva. The diagnosis so far has been made chiefly by the presence of the cup-shaped depression.

On vaginal examination a red, easily bleeding mass is seen, and a diagnosis must be made from prolapse of the uterus, a polypus, and inversion. The abdominal signs associated with the presence of the placenta on the fundus, sometimes the presence of the tubal openings, may determine the diagnosis.

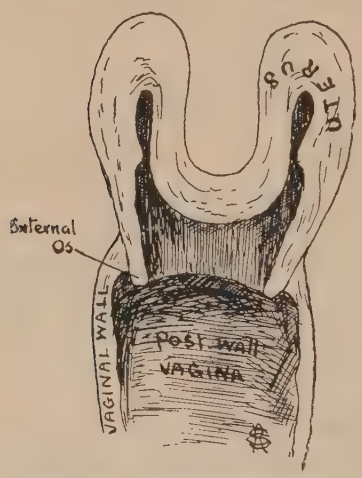


Fig. 230.—Partial inversion of the uterus.

Treatment. If the placenta is still adherent, remove it. It is quite irrational to push the infected placenta into the uterus as suggested by some authorities. Having peeled off the placenta, push the uterus into its proper shape and position. To push back the uterus, reduce it like a hernia. Squeeze the fundus with all the fingers and at the same time push it upwards.

Another method is to pass the finger into one groove at the side of the uterus and push upwards, and then into the other groove and push upwards. In this way the inversion is gradually reduced.

SUDDEN OR RAPID DEATH AFTER CHILD-BIRTH

1. **Haemorrhage** is the most common cause.

2. **Shock,** by which is meant some profound nervous depression, whether it lead to vaso-dilatation, syncope, or other physiological change. One of our patients with hydramnios collapsed suddenly just after rupture of the membranes and died in a short time. The membranes were ruptured artificially after they had appeared at the vulva.

3. **Pulmonary embolism.** An embolus that plugs some part of the pulmonary artery usually causes death. It may occur any time after the child's birth up to late in the puerperium. It is more frequent after, than before, the tenth day. Sometimes pulmonary embolus leads to sudden death. The onset of the condition is terribly sudden. It certainly occurs more often in septic than in normal patients, and it is probable that it will not happen unless there has been some infection.

Signs and symptoms. The sequence of events is usually as follows. The patient is suddenly seized with dyspnoea and a violent pain in the chest. She falls back, if she is sitting up, or in any way exerting herself, and begins to gasp for breath. Her chest heaves convulsively, her face is first livid and then pale. She urgently demands that the window be flung open so that she may have air. The pulse is rapid and may be uncountable.

If the chest be examined it will be found that no air is entering the greater part of the affected lung.

After a short or prolonged struggle the patient sinks into unconsciousness, in which she may remain for several hours before death or recovery.

If she recovers, dyspnoea is apt to return with slight exertion. She may have a series of similar attacks resulting eventually in death, or recovery.

Treatment. The damaged lung cannot be put to work again. All that can be done is to give free access of air and free use of the respiratory muscles. Open the windows and doors of the room. Take all weight of the clothes from the patient's chest. Give nothing by the mouth, for a gasping patient is likely to choke. Let a very gentle stream of oxygen flow through a tube placed in the patient's mouth. Give a hypodermic of strychnine (gr. $\frac{1}{10}$) and repeat this if necessary. Ammonia, atropine, morphine, and camphor in oil, may all be used.

4. **Air embolism.** Aspiration of air into the uterus and its entry into the veins is said to cause death. Many of these cases have been shown to be due to the formation of gas in the blood after death by the bacillus aerogenes capsulatus. There is a good deal of scepticism on this

question of air embolism, though in rare cases it seems to have been the cause of death.

5. **Inversion of the uterus.** This also produces a sudden diminution of intra-abdominal pressure, but atony of the uterus, such as precedes inversion, is itself accompanied by shock.

PART V

ABNORMAL PUERPERIUM

CHAPTER XXI

PYREXIA IN THE PUERPERIUM

BEFORE considering the main cause of puerperal pyrexia, *i.e.* infection, we must first deal with the other causes of fever. These may be divided into (*a*) Psychological, (*b*) Pathological.

(*a*) **Psychological.** These vary. (1) Slight. (2) Severe (Insanity).

(1) Under this heading must be placed the rise of temperature (see Fig. 231) which follows the receipt of bad news. In hospital we have frequently noticed that rise of temperature is far more common on visiting days than on other days. Husbands, and others, visit the patients, tell them something unpleasant, the temperature and pulse-rates rise. Nothing is done: in the evening, temperature and pulse are normal once more. This impels us to insist on "no visitors" during the first week in our private practice. The temperature may rise through the baby being noisy, through the nurse being cross, or even through some minor cause such as some little trouble with servants in the house: the last suggests one of the many reasons for urging patients to go to nursing homes.

(2) **The Insanities.** It is convenient to deal with this unfortunately common abnormality here.

It is usually divided into—

(1) The Insanity of Pregnancy. This is uncommon, and includes about 10 per cent. of the cases.

(2) The Insanity of Labour. About 10 per cent.

(3) The Insanity of the first six weeks after delivery (formerly called the Insanity of the Puerperium). About 50 per cent.

(4) The Insanity of the Lactating Period. About 30 per cent.

Varieties. Melancholia and Mania.

Melancholia is most usual in pregnancy and in the lactation period.

Mania is found more often in labour and within six weeks after delivery.

Causes. Reproduction is the test of a nervous woman, and should she be in any way mentally or physically weak, her brain may give way under the trial. Insanity associated

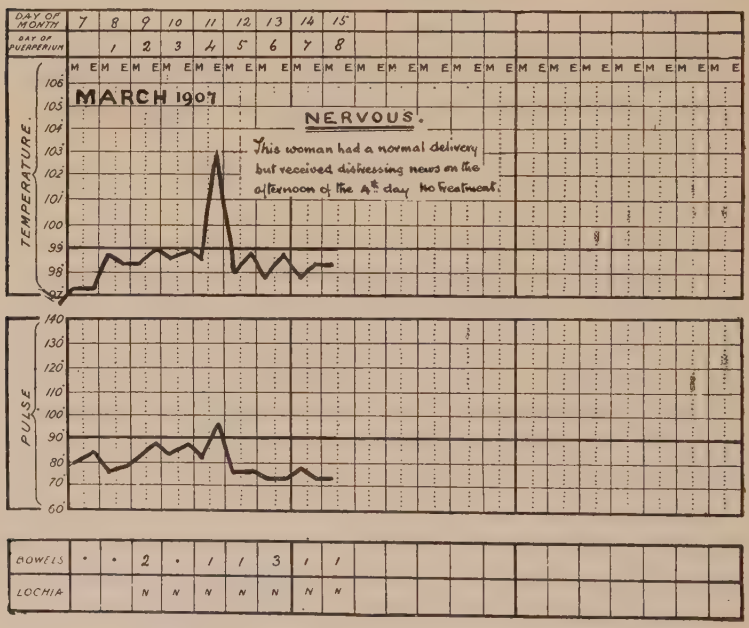


FIG. 231.—Temperature due to nervous influence.

with child-bearing forms about 10 per cent. of all mental diseases among women.

Subsidiary causes are—

(1) Drink.

(2) Toxaemias, especially eclampsia.

(3) Acute pain (a woman may become a raving lunatic with the head on the perineum).

(4) Sepsis.

(5) Severe haemorrhage.

(6) Prolonged lactation. A highly-strung woman should not be allowed to nurse her baby, or even a woman with a

bad family history of insanity should be dissuaded from so doing.

(7) Unmarried mothers. Under this heading may be placed any form of worry.

(8) Heredity.

Symptoms.

Insanity of pregnancy. In pregnancy some change of character is common. Only when it passes into definite delusion does insanity become established. The onset of the insanity of pregnancy is recognised by an exaggeration of this change of character. From the fourth or fifth month of pregnancy onwards the patient becomes moody, irritable, or apathetic. Insomnia in the reproductive period is always of serious import; when severe it often means the onset of insanity. The patient begins to sleep badly. Then she becomes definitely insane. She has delusions. If she vomits, she thinks she is being poisoned. She usually becomes melancholic. She sighs and groans, and nothing can shake her from her misery. She is usually constipated. She may be suicidal. She may get well before the birth of the child, or not until after its birth. In other cases she does not get well at all, the insanity becomes chronic, and the woman sinks into a condition of dementia. This form of insanity is frequently associated with the toxaemia of pregnancy.

Insanity of labour. Frenzy seizes the patient as the head passes the vagina and vulva, and she may kill the child. The attack usually passes off rapidly.

Insanity of the puerperium. This is nearly always associated with either severe anaemia from haemorrhage, or with sepsis. The patient is first irritable and uneasy about unknown dangers. She has a headache. She may refuse food. Her bowels are confined. Above all, she sleeps badly. She dislikes to see either her child or her husband. She finally becomes definitely maniacal. She may have suicidal impulses. About 80 per cent. get well.

Insanity of lactation. The patient is not in full health. She is probably a multipara, who has had frequent pregnancies and exhausting lactations. She becomes gloomy,

she sleeps badly, and her bowels are confined. She becomes definitely melancholic with delusions, and may try to commit suicide. The outlook is not quite so good as that of puerperal insanity.

Prognosis. Taking all forms, the prognosis is good, for some 60 per cent. of all patients recover. If the patient gets fatter, and her mind improves with her stronger physical condition, prognosis is good. If her mind does not improve with her bodily condition, prognosis is bad. The prognosis also depends on parity. She should be warned to have no more children, for a further pregnancy may precipitate an incurable insanity.

Treatment. Carefully examine the patient for any disease, or other exciting cause, and treat such disease to relieve her of the additional strain. An insane woman should not nurse or have the management of her child. If puerperal infection is present, treat it. Four things are necessary to enable a patient to stave off, or to recover from, an attack of insanity:

1. Plenty of sleep.
2. Plenty of food.
3. Avoidance of constipation.
4. Plenty of exercise.

Whenever a woman during the reproductive period suffers from sleeplessness, or shows change of character and capricious appetite, or is constipated, endeavour to overcome these defects, bearing in mind that, if this is done, any tendency to insanity is greatly decreased.

When the attack is established.

1. The patient must have plenty of sleep.

She may be given the well-known three fifteens of most hospital formularies, *i.e.* 15 grains each of potassium bromide and chloral hydrate with 15 minims of tincture of opium, or else potassium bromide in one-drachm dose every three hours may be given. Many other hypnotics are commended, such as paraldehyde, chloralamide, dial, either separately or in combination.

Morphine sometimes acts well, but often fails. If the patient is acutely maniacal, hyoscine (gr. $\frac{1}{100}$) given sub-

cutaneously sometimes acts like a charm, the patient at once falling into a deep sleep with noisy breathing. Scopolamine should also be tried in these cases.

A wet pack is often most effective in inducing sleep. If the patient is an alcoholic, an enema of ℥ii to ℥iii of whisky, following chloral and potassium bromide, may turn the balance in favour of sleep.

2. The patient must have food.

Although a patient with acute mania has a quick pulse and a dirty tongue, it is astonishing how much she will eat. Her incessant restlessness needs a large supply of food. Whether she be melancholic or maniacal, as long as she will eat, let her eat as much as she can. If she refuses food, only firmness will conquer her. Take the food and order her to eat it at once. If it is impossible to persuade her to eat, do not go away and leave her the victory. Pass the nasal tube, or stomach tube, at once. She may give in after this, for the procedure is disagreeable, and she may be cowed by being made to do what she did not want. If left, she may starve herself to death. As regards the amount of food, she can be given in one day as much as would suffice her for two or three days of ordinary health. Semi-fluid food, such as gruel, eggs, milk, cream, cod-liver oil, and pounded meat can be poured down a nasal tube.

Passing the nasal tube. Have some one to control the patient's head. Pass the tube, wet with warm water, into one or other nostrii, and push it back steadily and rapidly. The soft palate, irritated by the tube, contracts and pushes the end back against the posterior pharyngeal wall, and thus guides it into the oesophagus and away from the larynx.

3. The bowels must be kept free.

If the bowels are very confined and the patient is noisy, a drop or two of croton oil is often effective, and keeps the patient quiet. Put it on the tongue directly, or mix it first with a little butter and sugar.

4. General treatment.

Much depends on the capabilities of the attendants, and those accustomed to the charge of insane patients are to be preferred. One person must always be with her to guard

against any suicidal tendency, and to be ready for any outbreak of violence.

Leave as little as possible to relations, especially fussy and reproving female relatives.

The attendant sponges her night and morning with warm water.

Do not let her be strapped down. Strapping her down will madden her above all things, for she will think she is being tortured or murdered. If she struggles, the attendant should catch and direct, rather than oppose the movement. Put mattresses up against the adjacent wall, to keep her from injury during her struggles. The bedstead should be placed in the corner of the room in such a way that the patient can only get out from one side, and at this side the attendant should sit, so as to prevent suicide from any sudden impulse.

If it is possible to get her up, do so, and make her walk about the room, or, better still, in the garden. She will get tired and sleep better.

We treat these patients at home for a month, and if there is no improvement at the end of that time, the patient is best treated in an asylum. By this time the friends are exhausted, and not so repelled by the idea of an asylum as at first; nor is it necessary to give a gloomy prognosis, for patients frequently recover with asylum treatment.

It is very necessary to warn the relatives of the possibility of suicidal tendency. Two nurses should always be with the patient.

The bladder must always be attended to, for mental patients may injure themselves seriously through over-distension.

Pyrexia in the puerperium. Causes other than infection.

(*b*) **Pathological causes of Pyrexia in the Puerperium other than infection.**

(1) Constipation.
(2) Headaches.
(3) Toothache and Dental Caries.
(4) Boils.
(5) Breast trouble.

(6) Phlegmasia alba dolens.
(7) Cystitis, Pyelitis, Pyelonephrosis, Residual Urine.
(8) Puerperal haematoma.
(9) General diseases, such as Phthisis.
(10) Tetanus.
(11) Typhoid fever.
(12) Malaria.
(13) Pneumonia, Measles, Scarlatina, Diphtheria.

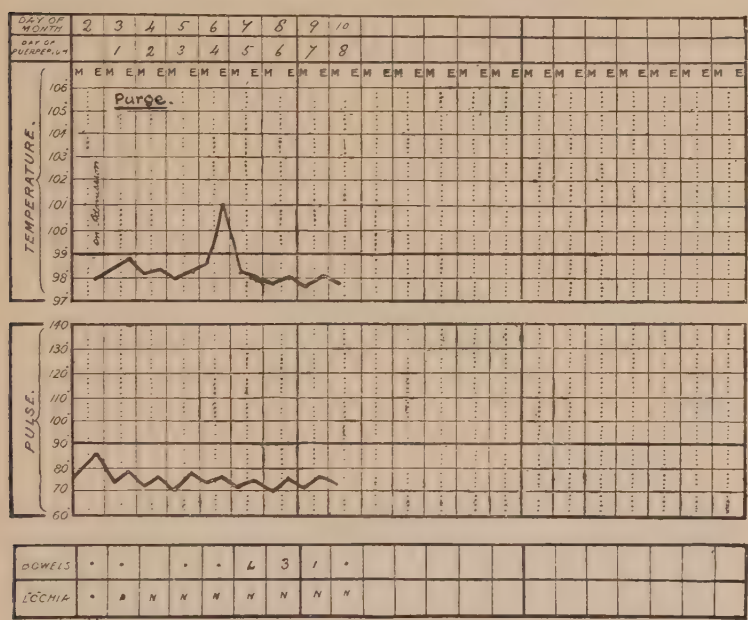


FIG. 232.—Effects of purge on temperature curve. (Notice Pulse Chart.)

Constipation (see Fig. 232). The concurrence of constipation with a raised temperature and pulse-rate in the early days of the puerperium is very frequent. We have had a patient with a sudden rise of temperature to 104° F. and pulse of 120, both of which fell to normal after the bowels had been opened. The reason usually stated for this pyrexia is that a puerperal woman absorbs toxins from her faeces, while a normal woman does not. We are doubtful if this is the explanation. In the recumbent position in bed which is assumed by puerperal civilised women there is not the free drainage of lochia from the uterus and vagina that there is

in the uncivilised woman, who goes about her business after delivery is finished. When the bowels of a patient are opened in hospital, she sits upon the chamber in bed, and thus provides a freer drainage of her lochia by gravity. The action of the abdominal muscles, the peristalsis of the rectum, and the straining, also tend to squeeze out the lochia. By giving our hospital patients a dose of compound senna mixture on the second night after the delivery, we encourage a free action of the bowels, necessitating frequent sittings-up on the chamber. In private practice we do not object to patients sitting upon the chamber in bed in order to evacuate the bowels. For a similar reason, patients are allowed to turn over on the hands and knees to pass water in the first twenty-four hours, unless they have suffered from shock or collapse. In other words, constipation causes rise of temperature by preventing proper drainage of lochia. When the patient sits up to empty her bowels, the lochia flows, and the temperature comes down.

Headaches. Headaches may be caused by sepsis, constipation, and numerous other things. When a cause is ascertainable, remove it: if no cause can be found, give a powder or cachet containing aspirin grs. 5 or pyramidon grs. 5 and caffeine gr. j.

Toothache. Ask a dentist to see the patient. If an abscess is present it should be opened. There is no objection to nitrous oxide in the puerperium, but local anaesthesia is not advisable if the woman is nursing her baby.

Boils or septic spots in any part of the body may cause rise of temperature and should be attended to.

Breast trouble.

(1) Engorgement.
(2) Nipples (cracks, etc.).
(3) Mastitis.

1. **Engorgement.** This may arise two or three days after delivery. The patient gets a rise of temperature with severe pain in the breasts, which are thick and knotty. This is simply due to the incoming milk, and will be relieved by properly fitting breast support, and the sucking of the baby.

In former days, milk fever was so called because "septic infection" happened to coincide with the day of establishment of the milk. Most patients get their breasts filled with milk without rise of temperature. When a rise does occur, pelvic causes must be excluded.

2. **Nipples.** Cracks or abrasions of the nipple may cause rise of temperature in the puerperium. The "crack" is usually seen at the junction of the nipple and areola, but it may also be seen across the top of the nipple.

Cause. "Over-care" of the nipples in pregnancy predisposes to the condition. The correct management of the nipples is described on p. 46. Energetic suckling by a baby before the milk is established, and suckling by a baby with tongue-tie, may also cause trouble.

Treatment. Do not order hardening agents during

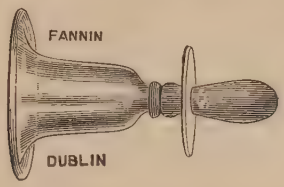


Fig. 233.—Nipple shield.

pregnancy, get the patient to use some emollient. Suspect tongue-tie. When a nipple becomes sore, do not allow it to get to the stage of cracking. On the first appearance of abrasion, order a Dr. Wansboro' nipple shield. These are little "tin hats" which are wonderfully successful in preventing further trouble: they should be kept on if a crack appears: in fact it is a good plan to use them as a routine. The cure of a crack in the nipple is accomplished chiefly by rest, therefore, in addition to the above-named shields, feed the baby through a nipple shield (see Fig. 233). Curative agents are many. The best in our practice has been compound tincture of benzoin: sometimes painting the crack with the silver nitrate stick is more efficacious. Either of these drugs should be washed off before the baby is allowed to go to the breast.

Management of a nipple shield. If the baby refuses to suck the shield's nipple, squeeze a little breast milk into

the shield, and wet the surface of the nipple with the milk. This will induce the baby to suck. The nipple shield is boiled before and after use, and its nipple is treated in the same way as the teats of bottles (see p. 650).

Mastitis.

Inflammation of the breast is divided into—

(1) Parenchymatous.

(2) Interstitial.

Fig. 234.—Diagram showing typical area of inflammation in parenchymatous mastitis.

This classification is important, for, as will be seen below, the two varieties vary in cause and treatment.

Parenchymatous Mastitis. This is different from the engorgement of the breasts already described. The inflammation is limited by the epithelium of the milk ducts, and is caused usually by milk decomposing over the nipple: this is followed by bacterial invasion, which spreads in the direction of the ducts. The patient complains that the breasts feel full and are painful. On examination the breast is hot, and perhaps a little tender, and there is a wedge-shaped area (see Fig. 234) of breast tissue, with the apex pointing to the nipple, harder and more tender than the rest of the knotty breast. The skin is flushed over this area.

The patient's temperature may be raised (see Fig. 235), and she may feel unwell, but constitutional symptoms are usually slight.

Treatment. The child should not be taken from the breast. Sucking acts in a somewhat similar way to Bier's hyperaemia treatment and relieves congestion. There is no pus present. The breast is kept well supported. Hot fomentations are applied. The bowels are kept regular. This treatment will probably abort the inflammation, but

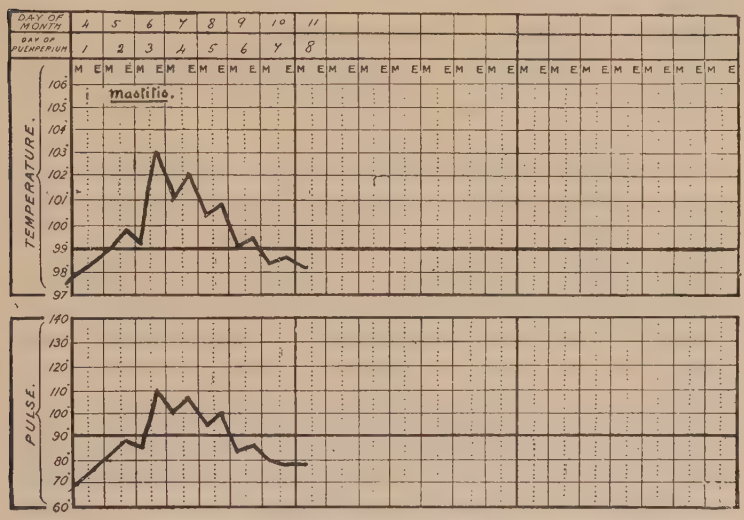


Fig. 235.—Chart of mastitis.

sometimes the bacteria invade the ducts, and an interstitial mastitis occurs.

Interstitial Mastitis.

Cause. A cracked nipple or spread from a parenchymatous mastitis may be the causal factor.

Signs and symptoms. In this, constitutional symptoms are more pronounced. The temperature may be very high, 104° F. is common, the pulse rate is raised, the patient feels very ill, has headache, anorexia, and may even have rigors. The pain is intense, the area of inflammation is not limited, nor is it wedge-shaped, in fact a typical abscess is present with oedema and pitting on pressure. Suppuration is invariable.

Treatment. If it is not certain that an abscess is present, treat the breast with hot fomentations and rest, as in the parenchymatous variety. Bier's hyperaemia apparatus, which is a large bell-jar fitting over the breast, may be considered as a treatment. It is exhausted with a large-sized hand pump. This treatment takes a long time and is not as successful as the surgical. It lasts for forty-five minutes every day, the cup being applied for five minutes at three-minute intervals. A small puncture is made into the indurated area before the cup is applied.

When pus has been diagnosed definitely, or when a woman comes with a sinus already formed, the following operation is advised and has been extremely successful in our practice.

Wash the skin of the breast.

Give the patient gas or ether, but not chloroform. We have found the last a very dangerous anaesthetic in all septic conditions.

Make an incision about an inch long over the lowest, not the reddest, part of the inflamed area. Push a gloved finger through this incision, and break down the affected breast tissue. Healthy breast tissue will resist this tearing action, unless great force is used. The diseased tissue will readily break down under the finger, which continues its action as long as it does so. When this tissue has been broken down, explore with the finger, and form a mental picture of the cavity and pockets that have resulted from the manipulation. Pass in a glass nozzle attached to a douche-can, and flush out each separate recess and pocket with cyllin solution ($\frac{1}{2}$ a drachm to the pint). Take several long strips of iodoform gauze, soaked in 2 per cent. carbolic acid lotion. Pack this gauze strip by strip into each separate recess or pocket with a plugging forceps. At the end of the operation, every part of the abscess cavity has its whole surface in contact with the gauze. If this is not so, but a pocket is left, this pocket will form the starting-place of a fresh inflammation of the breast. Cover the breast with a hot fomentation and bandage it tightly. On the next day the plugs are withdrawn and some pus runs out. Again douche out the cavity and plug again, this time without an anaesthetic. Repeat on the third, fourth, and fifth days. By the fourth or fifth day,

only a little watery fluid escapes on the withdrawal of the plugs. Further drainage is now needless. We do not even insert a wick of gauze between the lips of the wound. Cover the breast with wool, and again bandage firmly for two days. The clean granulations adhere to one another, and the abscess cavity is obliterated. Only in the event of some pocket escaping the action of the gauze and carbolic will another abscess arise, and then it is small and readily cured by incision and drainage. Hot fomentations are changed very often: they do no harm, and they are an enormous relief to the patient. At the second dressing, a 2 per cent. solution of cocaine smeared on the edges of the wound makes the dressing more simple.

Phlegmasia alba dolens, or white leg.

Venous form. This is the most usual variety. It may arise locally, from a phlebitis previous to labour. This is a simple matter, gets well quickly, and commences within about a week of the confinement. The treatment is the same as for the more **generalised form,** which is usually a *septic* condition spreading from the placental sinus, via the external iliac vein, to the femoral vein, thus causing a femoral thrombosis. It may also travel via the uterus to the common iliac veins, upwards to the inferior vena cava, and down the external iliac to the leg vessels. Thrombosis may be found in the crural, saphenous and popliteal veins.

Extravenous or lymphatic form. A rarer form of white leg follows the coagulation of the lymph in the lymphatics of the cellular tissue, occluding the vein by pressure.

Onset. Owing to the slow spread, the onset is delayed, and may not occur until four to five weeks after the birth of the child.

Signs and symptoms. Most cases of white leg are septic, but some few are not septic.

The non-septic cases occur when the circulation is feeble, or the veins varicose. There is no raised temperature or pulse-rate in these cases, but in other respects they are similar to septic cases.

The septic cases have usually had some signs of puerperal infection. They set in with violent acute pain in the leg,

and tenderness, accompanied by fever. If the patient is up, she notices that her leg is heavy, and she feels as if she were walking on wool. When seen, the leg is tender, red, and swollen, but does not pit on pressure. The hard, tender cord of the thrombosed femoral or internal saphenous vein is readily felt. In a day or two these characters change; the leg becomes white, and pits on pressure.

The leg is a little different in the purely cellulitic or lymphatic form. The swelling is hard, and never pits on pressure. It begins in the thigh, whereas in the venous form it begins in the leg. Rarely, too, the skin may show patches of gangrene at a later stage. The two conditions are not infrequently mixed. The left leg is more commonly affected. Swelling of the one leg may be followed in a week or two by swelling of the other.

Prognosis. White leg is a local disease, and does not kill of itself. Its great danger is pulmonary embolism. We have seen a patient, who had been in bed five weeks, die in a few minutes from a pulmonary embolus, dislodged by the effort of raising herself on a bed-pan.

Treatment. The main purpose of treatment is to avoid all risk of pulmonary embolus.

Take the child from the breast.

Rest the affected leg on two pillows with the knee a little flexed, and keep the leg still by placing sand-bags on each side. The leg must be kept warm to avoid gangrene. The best way to do this is to wrap it round with wool. If there is much pain, use lint soaked in lead and opium lotion equal parts, or soaked in glycerine and belladonna, or ichthyol one part and glycerine nine parts; the last is most satisfactory. Put a cradle over the leg to keep the weight of the clothes from it. Never massage the limb, and palpate it very slightly, when feeling for the swollen veins.

Give medicine so that the bowels are opened daily, for straining at stool may result in pulmonary embolism. The nurse must lift the patient on to the bed-pan. She must not help herself.

If the thrombus suppurates and forms an abscess, open it. Provided pyaemia does not ensue, the patient will then get well. Give her good food, and allow abundant fresh air.

She must stay in bed for at least two weeks after the pulse and temperature have returned to normal. Massage should not be started until six or eight weeks later.

When the patient is allowed to get up she finds her leg is not as strong as the unaffected leg, and it may remain weaker for years. It feels heavy, tends to swell and ache, gets cold, and the toes are subject to chilblains in winter.

To prevent this, tell the patient to keep the leg warm by an extra stocking. Bandage the leg firmly and evenly with a crepe bandage from the foot up to the middle of the thigh, or get her to wear elastic stockings. Tell her to take plenty of exercise, but not to stand. We find that bicycling is efficacious in promoting a better circulation in the later stages. When she rests, it should be on a sofa with the leg raised.

Cystitis, Pyelitis, Pyelonephrosis.

The last two have been dealt with when considering the abnormalities of pregnancy.

Cystitis as a cause of pyrexia in the puerperium must be considered here. It is nearly always caused by frequent catheterisation, especially when associated with laceration of the perineum, and occurs in a *subacute* form. It may arise and has been seen by us as an acute condition developing from a gonorrhoea about a week previous to the labour.

Diagnosis. This is simple; in the *acute form* a high rise of temperature and pulse-rate, very severe pain in the hypogastrium, exquisite agony on micturition. The patient tries to void urine but cannot. It is impossible to palpate the lower abdomen because of the agony, and it may be difficult to differentiate from an acute abdomen. Usually the history of the case and catheterisation will distinguish cystitis. In the subacute form, which is a more common condition, the symptoms and signs are all less pronounced, and consist of rise of temperature and pulse, frequency of micturition with pain. The urine is alkaline, contains albumin, pus, and sometimes blood.

Treatment. When a diagnosis is made, give morphine gr. $\frac{1}{4}$ for the pain. Apply hot fomentations over the bladder region. Give barley-water, Contrexeville water to drink.

Hot hip baths sometimes relieve. Saline purges, urotropin, and sodium benzoate may be given. In the acute stage, *do not* irrigate the bladder; when it has become subacute, the bladder should be washed out with boric solution ʒi to the pint, or saline solution.

Puerperal haematoma. This may cause rise of temperature and pulse-rate by reason of the fact that it may break down and suppurate, when all the signs of an abscess will be present.

The treatment is the same as in labour.

General diseases, such as **phthisis** and **typhoid fever,** must not be lost sight of.

Tetanus has arisen in the puerperium, but is very rare.

Malaria in the puerperium is often the bane of the accoucheur. The patient, who usually gives a history of malaria previously, suddenly develops a rise of temperature and pulse, with rigors. There may be no symptoms or signs of puerperal sepsis, and yet it must not be lost sight of. All the symptoms and signs of the latter must be sought for. A swab should be taken from the cervix and body of the uterus, and possibly from the blood. The organism of malaria must also be sought. Unless the latter is positive, and sepsis is distinctly negative, a diagnosis of malaria should not be made. When made, large doses of quinine (from 10 to 20 grains three times a day) should be given.

Pneumonia, Measles, Diphtheria and **Scarlatina** may be present. The last is the most difficult to diagnose, for the rash is suggestive of a septic rash. Possibly, on a thorough investigation being made, the period of incubation will be apparent, a history of infection will be elicited, and the peeling of the skin will determine the diagnosis.

CHAPTER XXII

PUERPERAL FEVER: GENERAL CONSIDERATION

HAVING considered in Chapter XXI the subject of fever in the puerperium caused by non-pelvic conditions, this will now be dealt with under the general term Puerperal Fever. Firstly, the subject will be dealt with in a general way—then the different types will be considered in detail.

Causes. These must be grouped under:

(1) Predisposing causes:

(*a*) Long labour or manipulations, especially vaginal examinations.

(*b*) Operative labour.

(*c*) Diminished vitality, *e.g.* anaemia, wasting disease, etc.

(*d*) Toxaemias.

(2) Determining causes:

(*a*) Lacerations in the vagina, perineum, cervix, septic hypodermic or transfusion needles.

(*b*) Autogenous infection.

(*c*) Heterogenous infection.

(3) The Bacteria. The variety of these is great. They may be divided into:

(*a*) Pyogenic. Streptococci, especially haemolytic and non-haemolytic.
Staphylococci.
Bacillus coli communis.
B. pyocyaneus.

(*b*) Anaerobic saprophytes.
Proteus vulgaris.
B. aerogenes capsularis.

(*c*) Specific. Gonococci, Diphtheria bacilli.
Typhoid bacillus, pneumococci, etc.

The aetiological factors must now be considered.

Long labour. This acts as a predisponent in several ways. Principally, it lowers the resistance of the patient, even if no examinations are made. In addition, the length of the labour predisposes to examinations. Vaginal examinations must be avoided as much as possible, for it is well known how infection may follow, in spite of all care. It is difficult to make suggestions as to how to avoid a long labour. Antenatal care will help, especially by advising the induction of labour in suitable cases, and thus avoiding long and weary confinements.

Operative labour. It is thought by some that forceps and other operative manipulations are perfectly safe. Morbidity is greater with operative interference of any kind than in normal deliveries. Increased morbidity means greater mortality. Avoid then all unnecessary operations.

Diminished vitality, *e.g.* anaemia, wasting disease, etc. A woman with lowered resistance is more liable to sepsis. This again means increased antenatal supervision, for a patient who is, *e.g.*, anaemic, may be given iron, arsenic, haemoglobin, etc., and wasting illnesses, etc. can be combated by good food and the administration of suitable strengthening medicines.

Toxaemias. It is now established that toxaemias predispose to infection. This can be brought about in various ways. Operative interference may be necessary, and induction of labour is well known as being a dangerous procedure unless carried out most carefully. Some observers have suggested a definite bacterial origin for toxaemia: this is not established. But there is no doubt that, whether from lowered resistance, bacterial infection, or instrumental delivery, the incidence of sepsis among toxaemic patients is very large.

Determining causes.

Lacerations in the vagina, perineum, cervix, etc. Any injury will predispose to infection, which may cause either a mild infection, or even an acute pyaemia may arise. Infected ligature material must always be remembered as a causal factor.

These will be considered on p. 528.

Autogenous infection. It is sometimes extremely difficult to trace the source of an infection, and "autogenous" has become a catch phrase for those cases the origin of which is difficult to trace. We are slow to believe that many such exist, and a close inquiry into many of them reveals coitus immediately before labour, or some such similar condition. Many observers have found virulent organisms present in the vagina and cervix before labour. Bigger and Fitzgibbon investigated a large series of cases at the Rotunda Hospital, and in 54 per cent. of them streptococci (non-haemolytic) which were in the vagina ascended to the uterus after delivery. Only two of these patients, however, developed pyrexia in the puerperium.

This investigation proved fairly definitely that infections are heterogenous. For all that, many cases have occurred at the Rotunda—some of which have terminated fatally—where there appeared to be no chance of contamination from outside—where no vaginal or other internal manipulations were carried out. As already stated, streptococci have been found in the vagina before labour. The haemolytic variety is unusual, but has been found on several occasions. It is difficult in a case of so-called autogenous infection to exclude such foci as the teeth, the antrum and frontal sinuses, the urine, tonsils, and other such sources.

There is no doubt that in spite of infection being caused by different bacteria, the most common and the one which gives rise to greatest anxiety is the haemolytic streptococcus. The others which are mentioned in the above list may cause trouble, but not usually of a serious nature. An exception to this dictum is the gonococcus, which is of danger when found in association with other bacteria. Occasionally some varieties may give rise to a serious if not a fatal septicaemia. Saprophytic organisms give rise to symptoms, although some authorities disagree with this, and suggest that pyogenic bacteria must always be present. We believe that sapraemia *per se* exists, and, as will be explained later, it is a convenient term applicable to a clinical condition which is susceptible of diagnosis and treat-

ment. The fact of a culture showing a haemolytic growth, while indicating danger, does not by any means mean a fatal conclusion. Haemolytic streptococci have been found in the normal vagina, and this fact alone makes us reiterate our warning about vaginal examinations. It is well to remember that organisms may be deposited on the instruments or gloves of the operator when speaking or coughing. The prevalence of these organisms need not be urged. All of them are constantly attacking the health of human beings; and in human habitations streptococci, staphylococci, and bacillus coli are always to be found. Infection by bacillus coli is obviously a constant danger, considering the nearness of the anus to the perineum and vulva.

These organisms often act together. Thus, a shaggy endometritis, due to bacillus coli associated with streptococci, is a condition of extreme danger.

The frequency of infection by pneumococci has been under-estimated. It has been demonstrated in several of our patients, one of whom died. In this case it is almost certain that the infection could not have been introduced by the vagina. In another case it was found in a septic uterus after spontaneous delivery, no vaginal examination having been made. The patient had a diffuse bronchitis for several days before delivery.

Other bacteria cause puerperal sepsis, but those we have mentioned are by far the most common.

Pabulum of the bacteria. Micro-organisms live readily in lochia; they also live readily on dead material, such as retained bits of placenta, membrane, or blood-clot. They live, too, on raw surfaces. The intact mucous membrane of a normal vagina and cervix forms an insuperable barrier to the passage of bacteria in sufficient force to cause infection. After labour the mucous membrane is bruised and lacerated, and is no longer the barrier that it normally is.

Morbidity. The causes of puerperal infections and their importance.

The doctor who tells his friends he has never lost a case may possibly have had no immediately fatal result, but he

has probably had many a morbid case which finds its way to the gynaecologist either sooner or later. The morbid puerperal patient may recover unscathed, but it is more likely that she will be left with unhealed perineal and cervical tears, chronic parametritis, fixed retroversion of the uterus and salpingitis with resulting sterility. How often do we meet with "one-child sterility" which is probably due to some faulty technique at a confinement.

The health of the hospital depends to a large extent on the degree of morbidity. There is no method of estimating this which is perfect. For the sake of standardisation, we follow the B.M.A. standard, *i.e.* a patient whose temperature reaches 100° F. on any two takings between the second and eighth day is morbid. Deaths are included. Abortions are not. In addition, we have a standard of our own, which to our mind gives more evidence of real illness—more evidence, because, with the B.M.A. estimation, a couple of spasmodic rises may mean nothing. Our estimation is based on a rise of the temperature and pulse above 99° F. and 90 respectively, on three consecutive occasions on the bi-daily chart, the raised temperature and pulse-rate to be concurrent. A woman is considered morbid, under our estimation, between the second day and the day of departure, and all patients are included. This prevents the exclusion of these spasmodic rises, and is of great assistance. Morbidity and mortality can be avoided to a large degree by taking great care to avoid infection during the labour, and to conduct the third stage especially in a careful manner, endeavouring to get away the membranes and placenta in their entirety. Bacteria may gain entry to the parturient canal, or to the circulation generally, by means of infected instruments or fingers, or they may be carried up by sterile fingers or instruments from labia that have not been efficiently cleansed. These accidents can be avoided by a thorough cleansing of hands, as described on p. 138, sterilising of gloves, and disinfection of the vulva. In addition, we now shave the vulval and pubic hair in all cases admitted to the Rotunda. This is certainly a sanitary and satisfactory method, but the morbidity rate is not lower now than when shaving was

not done. The question of shaving in private practice is open to discussion. If the patient objects, clipping should be done. If, however, *intra-uterine* manipulations are to be practised, shaving is definitely indicated. In other words, puerperal infection (certainly all infection of a serious nature) is to be attributed to failure on the part of the nurse or medical attendant to preserve strict cleanliness. For example, if in hospital we get a bad case of sepsis, or a series of minor cases, a careful investigation is made as to how the patient was attended at birth, whether washing was efficient, whether the nurse had any other cases of infection, or any sore on her hands. If it be discovered that the nurse has any focus of infection, she is put off work, and swabs are taken from under her nails. When pronounced free, she is allowed to continue with her work, but is even then directed to wash the patient with swabs held in sponge forceps. So, too, every patient has separate, numbered utensils, towels, mug, basins. The bedding of a patient who has had sepsis is sterilised by steam before it is again used. Gloves are always worn by us in attending in any way to a puerperal patient's genitalia. We only give these as examples of the care that is needed in hospital to prevent sepsis arising, and we maintain that, were a like care exhibited in private cases by practitioners, puerperal sepsis would not be the scourge it is shown to be by the Registrar-General's returns.

Nor can the mortality of puerperal infection be regarded as a true guide to the extent of its ravages. It is doubtful whether many women recover completely from an attack of puerperal sepsis. In addition to the symptoms already mentioned, the woman may complain of vague pains, and she will say that she has never felt the same since the birth of the baby. We emphatically insist, as we have already done in this work, that the seriousness of sepsis is in no way measured by its death-rate—it is far better to measure by its morbidity.

General principles of puerperal infection, with especial regard to treatment. Micro-organisms cause puerperal infection, and the reason why a patient recovers is that she is able, either with, or without, or in spite of

her attendant's treatment, to overcome and destroy the infecting agent. Bacteria poison the baby by their toxins; the body depends on the presence and manufacture of protective substances to kill the bacteria and neutralise the poisons.

The researches of Semmelweis and his successors have taught us how we may best prevent infection. But in this chapter we are dealing with cases in which for some reason the prevention has failed and the body has now to overcome the infection. Clearly, as nearly all cases end in eventual recovery, the body is able to overcome the infection. Two questions of practical importance arise: How does the body overcome the bacteria and their toxins? and in what way can we aid its efforts?

It is well known nowadays that the body opposes bacterial attack in three main ways; but it is extremely difficult to determine in many a case of severe sepsis how the cure was effected, whether, *e.g.*, in a direct bactericidal manner or by increasing the phagocytic action of the leucocytes.

These ways are:

1. As killers. By means of substances in the plasma of the blood which kill the bacteria directly—the bactericidal substances.

2. By the presence of opsonins which combine with the bacteria and alter them, so that the phagocytes can destroy them.

3. By the elaboration in the blood plasma of antitoxins, substances that combine with and neutralise the toxins.

Of the common organisms of puerperal infection, streptococci, staphylococci, and gonococci are not much affected by bactericidal substances, but are readily opsonised and ingested by phagocytes. Bacillus coli is killed by bactericidal substances and opsonised. The toxins of all are neutralised in the body by antitoxic substances.

It may also be stated, as a law of the body's reaction, that when a patient is overcoming infection, the protective substances in the blood are in excess of the normal amount.

In other words, when bacteria attack the body, unless entirely overwhelmed by the violence of the attack, it responds by manufacturing a large amount of specific anti-bacterial substances with which to combat and destroy them. Sir A. E. Wright has shown that if a dose of dead bacteria is injected into the body, at first the power of resistance falls below, and then, with reaction, rises above, the normal. He has named the fall the negative phase and the rise the positive phase. Clinically the negative phase corresponds with the feeling of illness and the rise of temperature and pulse-rate that result from infection; and the positive phase with the feeling of betterment and fall of temperature and pulse-rate that result from the body's successful reaction.

The practical questions of treatment are :—

1. Can we help the bactericidal action?
2. Can we help the opsonic and phagocytic actions?
3. Can we help the antitoxic action?
4. Can we help the supply of the body's anti-bacterial substances to the affected part?
5. Can we prevent further attacks?

Can we help the bactericidal action? The answer to this must be tentative. Laboratory experiments give hope that by the injection of vaccines, composed of a stated number of dead bacteria, the manufacture of these substances may be augmented. This treatment has already shown excellent results in selected cases and gives great promise for the future.

Can we help the opsonic and phagocytic actions? Here vaccines again promise to be of value, but at present their use in acute cases has not been determined. There are, however, several substances which increase the number of leucocytes. Credé introduced the use of collargol, an organic compound of silver, with this object. It can either be injected into the veins in doses of one to two grains in water once a day, or ʒj of Credé's ointment (collargol gr. xvii to ℥j of lard) may be rubbed into the thigh once a day, the remnants of the previous inunction being first washed off with soap and water. Credé had strong belief in its power, but we have little faith in its action.

Rectal and subcutaneous injections of saline also increase leucocytosis, and probably increase the complement in the plasma. Such substances as collosal iodine (to be described later) act in an indefinite manner.

Can we help the antitoxic action ? Many antitoxic serums have been prepared. Polyvalent antistreptococcic serum, however, has aroused most interest. Its effect is at times magical, at others disappointing when the disease is well established. As a prophylactic in a suspected case, or if given in an established case at the very beginning of septic symptoms, we have found it of great value. These serums also increase leucocytosis, and in this way may prove beneficial even when not obtained from the special strain of bacteria responsible for the infection.

It is necessary to discover the presence of streptococci or staphylococci in the uterus or blood before using a serum. The distinguishing of bacillus coli must be left to bacteriologists, though the presence of a bacillus in the uterine lochia, with a shaggy endometrium and foetid lochia, is clinically diagnostic of its presence.

Other antitoxins have been used by us with some success. As an additional aid to collosal iodine, the different forms of puerperal antitoxin and scarlatina antitoxin have been experimented with. It is still too early to speak definitely either as to the effects of the puerperal antitoxin or the scarlatina antitoxin, especially as, at the time of writing, these are not even on the market. We have had no cases with any of these sera alone. In combination with collosal iodine they have all been of immense service. They have been supplied most kindly by the manufacturers, Parke, Davis and Co., and Burroughs, Wellcome and Co. Startling results have been achieved experimentally in the laboratories. The growth must be streptococcal if the injections are to be of use : with staphylococcus the injections are useless. We certainly advise further trial.

We do not for a moment advise against the use of the ordinary serum already on the market. We still use antistreptococcus serum (polyvalent) in dosage of 20 c.c. as a prophylactic and occasionally use it in treatment. The dose recommended of the puerperal antitoxin and the

scarlet fever antitoxin, is 10 c.c. When serum is used in treatment, it may be tried in doses from 10 to 100 c.c. The expense is great, and if it is found to be of no effect after three doses, it should be discontinued.

When using sera, *serum sickness* must be remembered. It is characterised by a rash, and sometimes vomiting. It is treated by the injection of 10 minims of adrenalin chloride 1/1000, the dose to be repeated if necessary.

Collosal iodine. The most difficult thing to prove in relation to this is how an hypothetical bactericide acts. Is it direct? Does it cause a leucocytosis and thus help bactericidal action? Does it increase the phagocytic action of the leucocytes?

This problem has confronted us very often of late, for we have been endeavouring to elucidate the mystery of the action of collosal iodine. We have used this substance with marked success for some time, but we do not know whether it acts by stimulating the thyroid and increasing the basal metabolic rate, thus increasing bactericidal power. This suggestion is made in the belief that the following argument is logical:

Sunlight and X-rays stimulate the thyroid. Iodine stimulates the thyroid. Haemobactericidal power is increased by sunlight. Iodine stimulates basal metabolism —sunlight, X-rays also. Possibly iodine, therefore, by stimulating the thyroid, increases basal metabolism and possibly increases bactericidal power. This has been proved by estimating the basal metabolic rate before and after the injection, and finding that an increase occurs.

How to procure and examine the lochia. It will be mentioned later, when to obtain material for culture. The method will be described now, which is carried out in the Rotunda Hospital, for obtaining swabs from the cervix and from the body of the uterus. The following instruments are required:

(1) Two sponge forceps, one to hold the swabs for cleansing the external genitals, the other to hold the cotton wool for cleansing the vagina.

(2) A Neugebauer's speculum with large and small end (see Fig. 236).

(3) A small forceps for holding the swabs for cleansing the cervix.

(4) A swab-holder for taking the swab from the cervix. This is the ordinary instrument used in general medicine.

(5) A special apparatus for taking the uterine swab (see Fig. 237). This consists of a bent glass tube containing

Fig. 236.—Solomons' modification of Neugebauer's speculum.

a swab with holder, the whole being placed in a sterile test-tube.

The patient is placed in the cross-bed position. Her legs rest on the operator's knees, or are placed across the

Fig. 237.—Apparatus for taking material for culture from the body of the uterus.

backs of two chairs, or are held by two nurses, or are placed in the crutches already described (see Fig. 122).

The external genitals are then washed up, and the vagina is cleansed with dry sterile wool held on a forceps. The Neugebauer's speculum is then passed. The cervical swab is taken. The cervix is then cleansed with cotton wool, and the bent tube is passed up to the fundus (see Fig. 238); it is withdrawn a little, and the swab is then pushed up to the fundus, after which it is drawn back into

the fine glass tube, which is then brought outside the vulva and placed in a test tube. It is then sent to the pathologist.

This method is simple and advantageous. The Neugebauer's speculum is suitable to quite narrow vaginae, and can be used without injuring the perineum. It is to be preferred to any method where the cervix is seized in bullet forceps or sponge forceps, for either of these may

Fig. 238.—Method of taking material for culture from the body of the uterus.

vaccinate the cervix with the bacteria which may be present. No antiseptics must be used for cleaning vagina or cervix, for they will spoil any result of the culture.

Occasionally a case may be met where it is vitally necessary to get a swab, and the vagina is too narrow to pass the speculum. Then the cervix must be grasped with a forceps, and the risk taken, after which a posterior speculum is passed and the remainder of the examination is as already described.

When an immediate microscopic examination of the lochia is to be done, smears are placed on the slides, which are allowed to dry, and are fixed by passing through a Bunsen flame. After staining with methylene blue the bacteria can easily be detected when present.

How to take blood for culture. This can nearly always be done directly, *i.e.* without cutting down on a vein. A tourniquet is placed around the upper arm. The median cephalic vein is identified, and a syringe which has been sterilised in an autoclave is used. The needle is plunged into the vein and from 5 to 10 c.c. of blood are withdrawn. This blood is immediately injected into broth. The broth is kept ready in a flask which is covered either by a metal or rubber cap : the needle of the syringe is plunged through this and the broth injected. The flask is then placed in the oven.

Can we help the supply of the anti-bacterial substances of the blood to the affected part ? The substances are supplied by the blood stream. We have means by which we can increase the flow of blood to the uterus and pelvic organs.

Inflammation is accompanied by increased flow of blood to the regions of microbic attack. If the intensity of the microbic poison is very great, stagnation of the blood supply results, and the phagocytes and anti-bacterial substances of the plasma are unable to reach and overcome the bacteria. The amount of lochia is a test of the amount of serum that is escaping from the infected uterine wall. In severe cases of sepsis the lochia dries up. The significance of scanty lochia is clear, and is of evil omen.

Methods of increasing the blood and lymph supply to an infected uterus. In past editions we have recommended various methods for helping in this increase of blood and lymph to the affected part. We have, however, given up to a large extent the amount of local treatment which we used to practise formerly. While it seems rational to use means to make lochia flow again, the danger of lighting up sepsis or invading new areas is very great. Increased supply of lymph may be stimulated by oxytocic drugs administered internally or hypodermically, such as ergot and quinine and pituitrin, but the intra-uterine and vaginal douche has been given up to a large extent, and their uses will be enumerated in the chapter dealing with special treatment. Bier suggested scarifying the cervix and applying to it a suction pump to cause local congestion. The

funnel and stem of the pump are made of stout glass, and the ball of strong rubber. This method of treating sepsis has never become popular. Hobb's glycerine method has had a vogue. Although we seldom practise it, the method is described on p. 549. Citric acid in drachm doses every four hours has been used to cause secretion of lochia: it certainly has caused epistaxis and subcutaneous haemorrhages. It can do no harm: it may help.

Pryor's treatment. We have not practised this method for many years, but as it is still adopted in some clinics, it is described on p. 550. It is only used for septic patients who have resisted milder treatments, and it consists of plugging the posterior fornix and uterus with gauze. It is supposed to act by drawing stagnant fluid from Douglas's cul-de-sac, and by setting up a local peritonitis which shuts off higher infection. In addition, a further flow of lymph occurs, and fresh adhesions are set up which are well channelled by lymph passages.

Can we prevent further attacks of bacteria? Here we have more scope. We can prevent, by the scrupulous cleanliness of our douching and examinations, the entry of other germs and the added danger of a mixed infection. Above all, if anywhere in the genital track there is pabulum on which bacteria can grow and multiply, and this pabulum is removable, we should remove it. Otherwise it forms a base from which fresh hosts of organisms can issue to attack the body. The power of the body to resist these added numbers has to be greater in proportion, and it is often so severely taxed that it may be entirely overcome.

For this reason, if there should be a puerperal ulcer, it is thoroughly cleansed by antiseptics and dusted with iodoform. If there is no ulcer, lochia retained in the vagina must be removed by postural treatment (see Fig. 239). A vaginal douche is never given for this condition. When lochia are retained in the uterus through displacement of the organ, replacement must be carried out.

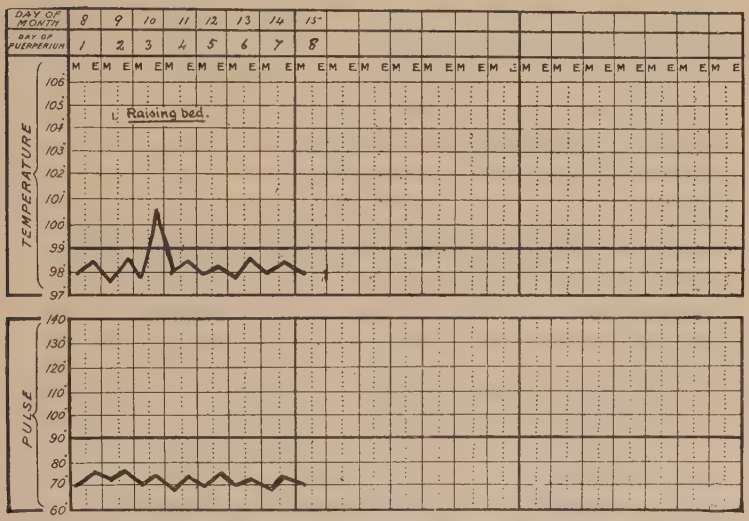
The indications for intra-uterine douching are described on p. 549. When there is any suspicion that pieces of placenta are present in the uterus, they must be removed.

If membrane be present, and it does not come away in the lochia, it should be removed.

Finally, moving about in bed, postural treatment, getting out of bed to get the bed made, etc.—all these help in removing pabulum for bacteria.

THE SIGNIFICANCE OF THE BLOOD CHANGES

Towards the end of pregnancy there is a gradual increase in the number of leucocytes, which may even reach



239.—Effect of raising the bed in a case of sapraemia.

15,000. This is a matter which has to be taken into consideration when interpreting the significance of a leucocyte count.

In the following account of the clinical application of the blood changes the teaching of Emery has been largely followed.

Under ordinary circumstances a leucocytosis of over 20,000 is a probable sign of suppuration ; violent haemorrhage may be responsible for a similar increase, as may an ovarian cyst with a twisted pedicle, or a volvulus.

When a septic infection is sufficiently acute, the system is overwhelmed and a leucocytosis does not occur, therefore when infection is known to be present, a slight leucocytosis or its entire absence is regarded as a very serious symptom.

In the acute cases there is also a very definite fall in the amount of haemoglobin, due to the breaking of the red blood cells. Thus an increasing anaemia in the puerperium is indicative of sepsis, and the prognosis is usually bad, other causes of anaemia, such as haemorrhage, being excluded; for in such conditions as internal haemorrhage (ruptured tubal pregnancy) there is a daily fall in the amount of haemoglobin.

The more severe the infection the more rapidly will the haemoglobin fall, and the same holds good of the red blood cells; under normal circumstances after delivery the latter should not be below 4,000,000; if on the third or fourth day of the puerperium the count is very much below this, in the absence of haemorrhage a diagnosis of sepsis is probable, irrespective of the number of leucocytes. If on a subsequent examination the count be still lower, the patient is almost certainly septic; the haemoglobin may fall as much as 10 per cent. per diem in severe cases.

When a fall has been occurring its cessation is of good omen, but better still is an increase in the number of the red blood cells, and the amount of haemoglobin.

The disappearance, or a great reduction in the number, of the eosinophiles is a bad sign, and their return a good one.

In conditions where the system has lost much fluid, as in diarrhoea, the blood becoming concentrated, an apparent increase in the amount of the haemoglobin is found; similarly the red blood cells are increased in number, but since the increases in these cases are not real, the prognosis given should not be influenced.

An increase in the red blood cells of more than 100,000 per day is probably false.

The sedimentation test has been found to be of great value in estimating danger to the patient. The method is described in the Appendix, p. 728.

A quick sedimentation time is dangerous, and a time of thirty minutes or below gives a very dangerous prognosis.

Examination of a puerperal woman with raised temperature and pulse. Having considered the extra-pelvic causes of pyrexia in the puerperium (p. 495)

and pelvic infections in general (p. 511), it is necessary now to examine the puerperal woman who has fever.

The temperature and pulse-rate should be recorded on a chart twice daily, at times as nearly as possible the same; *e.g.* 7.30 a.m. and 6 p.m. When a nurse goes into private practice, she must continue to keep to a chart as she has been taught in hospital. The doctor should get the report from the nurse, and look at the chart. When the tem-

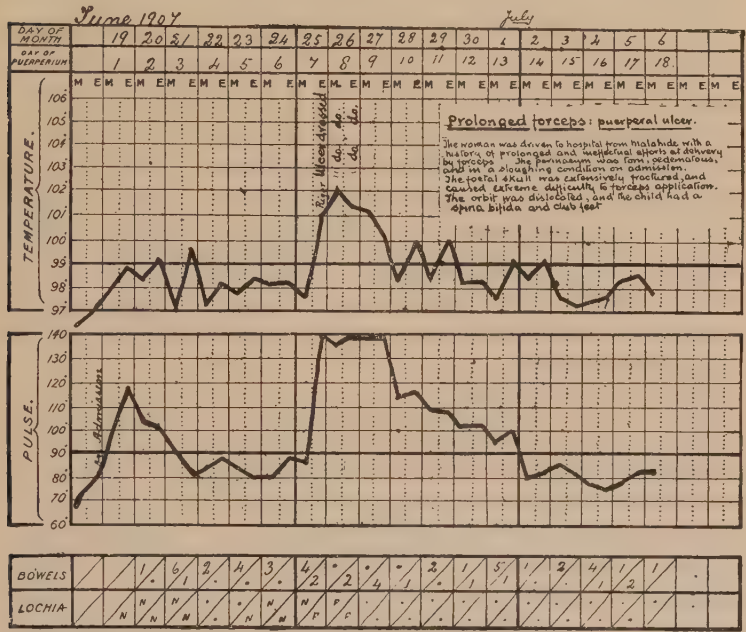


FIG. 240.—Chart of puerperal ulcer.

perature and pulse rise above 99° F. and 90 respectively, a cause should be sought for. The extra-pelvic causes must be excluded, and have already been enumerated (p. 495). A pelvic cause must now be ascertained.

The tongue is examined: the lochial pad also. The uterus is palpated to find out its height above the pubes, prior to examination of the perineum. Even though some possible extra-pelvic cause is present—even though the patient has malaria, phthisis, or some such constitutional disease, always remember that the pelvis is the most likely

site of the trouble, and exclude it before deciding finally on any other cause.

The Perineum (puerperal ulcer). Temperature (Fig. 240) may be raised by reason of the fact that the perineum is infected. This may arise in several ways : (*a*) the doctor has neglected to stitch a torn perineum; (*b*) non-union with resulting ulcer has occurred in a stitched perineum; (*c*) an ulcer may occur from sloughing of the mucous membrane due to traumatism and infection.

It is quite obvious that the perineum is the first place to think of as a cause of pyrexia. Puerperal ulcer is very rare at the Rotunda Hospital. A typical *puerperal ulcer* is a sloughing area with raised edges, purulent discharge, and a *greyish-white membrane* at its base. The labia are sometimes swollen. A minor degree of infection may occur. Typical stitch abscesses may be present in the line of the sutures : such a condition may be avoided by the use of sterilised and dyed silkworm gut, as described on p. 78. In addition, all aseptic precautions must be taken, *e.g.* in boiling instruments.

Treatment. The most important point in the treatment is to avoid upward spread of infection. This is done by raising the head of the bed, or by getting the patient in the right-angled sitting, up position (see Fig. 105). Also avoid douching of all sorts (vaginal and intra-uterine). Remove all the stitches. Place the patient on a douche pan and pour 50 per cent. peroxide of hydrogen over the perineum : this is done by taking a large pad of cotton wool soaked in the solution and squeezing it over the infected parts. Peroxide is safe and effective to use in this way : it is dangerous if used in such a manner that the effervescence tends to proceed upwards. A hot fomentation is then applied. The treatment is carried out twice daily, and the fomentations are changed every four hours. Eusol, 50 per cent., may be tried as an alternative. If there are definite black sloughs, pure carbolic or the silver nitrate stick may be used.

When the ulcer is quite clean, secondary suture of the tear may be done.

One point must be especially urged. When a perineum

has been unskilfully sutured it may heal superficially, and a pocket may be left deep which causes the presence of a small abscess tender to pressure. This is readily diagnosed, and is treated by removal of the sutures, with treatment as already outlined.

If the ulcer is high in the vagina, it may be necessary to use a vaginal nozzle attached to a can. The pressure of the fluid must only be just enough to allow the fluid to flow: the danger of forcing the septic fluid into the uterus is enormous.

RETAINED LOCHIA IN THE VAGINA

This is sometimes accompanied by a rise of temperature, and is caused by a very roomy vagina, or else by a perineum which has been stitched too tightly. It is one of those simple conditions that is difficult to diagnose. In addition to slight pyrexia, the lochia becomes scanty and foetid, and the patient suffers from headache, furred tongue, and a general feeling of sickness.

Treatment. Get the patient on her hands and knees two or three times a day: see that she is kept sitting up. Give collosal iodine 20 c.c. intravenously as a prophylactic. Give quinine hydrobromide grs. 5 and femergin (ergotamine tartrate) one tablet (gr. $\frac{1}{130}$) in case the retention is due to sluggish uterine action, for subinvolution may be accompanied by this condition.

This is the best method of treating retained lochia. We used formerly to recommend vaginal douching, but we have now given it up altogether.

RETAINED LOCHIA IN THE UTERUS

This may be caused by subinvolution or displacement. The latter occurs in the form of acute ánteflexion in the first few days of the puerperium—from the eighth day onwards retroflexion may be present. Either of these malpositions arise from parity: the heavy fundus drops either forward or backward.

Diagnosis. This is made by a rise in the temperature and pulse-rate, suppressed or scanty or odorous lochia, absence of the fundus from its proper position. The pyrexia (Fig. 241) is usually not great, the lochia is noticeably

smelly and scanty. The absence of the fundus will easily be observed.

Treatment. In considering treatment, one must remember that *suppression* of lochia is a sign of severe sepsis. When simple retention is diagnosed, the uterus should be encouraged to action by rubbing it up.

Purgatives should be given. Quinine grs. 5 and femergin one tablet are administered. A bimanual examination is

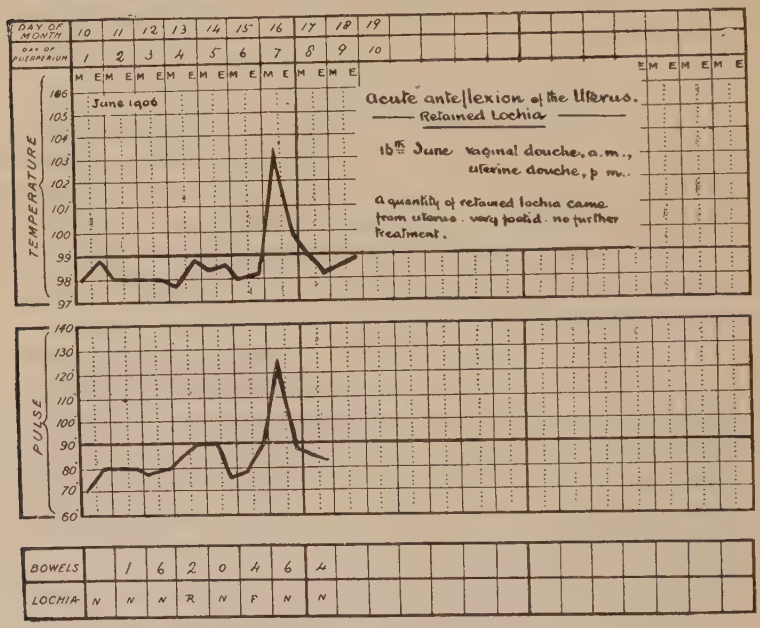


FIG. 241.—Chart of retained lochia.

made to determine position of uterus. If it is in retroflexion, it should be replaced: it will remain in position without a pessary, especially if the patient is recommended to be in the knee-chest position. A very important exception must be mentioned in relation to the replacement of a retroversion, the method of which is illustrated in Fig. 154. If, on trying to replace a uterus when there is accompanying rise of temperature, difficulty is experienced, do not force up the uterus: it may be held down by inflammatory adhesions, which if broken down may break up protective areas, and start or revive infection.

If, in spite of replacement, the fever persists, take a swab from the uterus, give intra-uterine douches, and put a piece of 3-inch iodoform gauze soaked in 20 per cent. carbolic solution into the uterus. Remove the gauze in twenty-four hours.

While awaiting the result of the swab, give 20 c.c. of collosal iodine prophylactically.

CLINICAL VARIETIES OF SEPTIC AND PUERPERAL INFECTION

These are divided for the sake of clearness and ease in comprehension into :

Local infection :

(*a*) Ulcers.—Puerperal, *e.g.* perineal, vaginal, cervical.

(*b*) Acute puerperal endometritis (known formerly as sapraemia).

General infection :

(*a*) Lymphatic sepsis.

(*b*) Venous sepsis or pyaemia.

We have already dealt with ulcers which may spread (from being a simple local condition) through the lymphatics, and cause a *lymphatic sepsis*, or the veins may become infected, causing thrombo-phlebitis, which may give rise to *pyaemia*, or else the latter may spread from the placental site, causing *acute venous sepsis*.

Each of these will be dealt with separately, after which a differential diagnosis will be made, and treatment considered.

ACUTE PUERPERAL ENDOMETRITIS

Known formerly as Sapraemia, this was supposed to be an intoxication due to the presence in the blood of the products of saprophytic and non-pathogenic bacteria. It is also called septic intoxication. The saprophytic bacteria feed and multiply on dead tissue, *e.g.* membrane. They cause toxic symptoms, but it is believed by most people nowadays, that, while they cause the conditions which have always been known as sapraemia, saprophytes do not circulate in the blood without pyogenic bacteria. While this is true, the train of symptoms known as sapraemia is so

definite, that as a clinical entity we believe it must be continued, but in view of the fact that other bacteria are always present, and that a definite leucocytic zone is set up, it must be regarded as a definite microbic condition which we shall call, for clearness, acute puerperal endometritis.

Putrefactive organisms can live on dead or dying material, but cannot overcome the resistance of healthy living tissue. Therefore their habitat will be the retained membrane, blood-clot or lochia in the uterus or vagina. In this medium they manufacture toxins which are readily absorbed, and to these toxins are probably due the constitutional symptoms which depend on the dose and virulence of the poisons. A large dose may cause a rapidly fatal termination. In acute puerperal endometritis the dose is seldom so great as to cause rapid death. In fact most patients recover.

Treatment is directed to increasing the patient's resistance, cleansing, *e.g.*, a puerperal ulcer, removal of the offending pabulum, *e.g.* membrane, placenta, etc. Thus, when a patient's temperature and pulse give evidence of septic intoxication, the vulva and vagina are examined carefully to seek for a puerperal ulcer : if the result is negative, the treatment for retained lochia, membranes, or placenta is carried out.

Symptoms and signs. The symptoms arise on the fourth or fifth day. The patient does not appear to be very ill, although she may have headache and loss of appetite. The temperature and pulse-rates are raised, the lochia is foetid, and an examination of the chart reveals the fact that the membranes are reported to be incomplete or torn. When some membrane is left behind in the uterus at labour, there is no need to remove it unless haemorrhage occurs, for it usually comes away in the lochia. If, however, pyrexia occurs, that there is present in the uterus this nidus of infection is an important factor in treatment. If, also, it is reported that some membrane came away on the lochial pad, although its presence had not been suspected, the continuance of raised temperature must make one suspect immediately more pabulum for bacteria.

To sum up then the symptoms and signs of acute puerperal endometritis—sapraemia. Raised tem-

perature and pulse about the fifth day, dirty tongue, general appearance of toxaemia. There is subinvolution, and foetid lochia which may occasionally be very haemorrhagic, especially if a piece of placenta has been retained.

Treatment. We have modified our views with regard to treatment since the last edition. Then, we advocated douching—vaginal and intra-uterine. We believe we douched too often, but there is a tendency to allow the pendulum to swing too far in the opposite direction and to forget that sometimes an intra-uterine douche is a very valuable proceeding. Our treatment nowadays is firstly to get a swab, cervical and intra-uterine, with a view to vaccine treatment. We give collosal iodine 20 c.c. as a routine. Femergin tablets t.d.s. are given to assist in toning up the uterus and helping it to get rid of the lochia. Quinine grs. 5 t.d.s. is also ordered. Great care is taken that the patient sits up well in bed, and sometimes she is ordered from the bed. Fomentations of magnesium sulphate ℥ii to the pint over the abdomen often help involution. Vaginal douching is *never* ordered in these cases. Intra-uterine douching is done occasionally. Bimanual exploration is rarely practised. An intra-uterine douche is given if the temperature and pulse do not settle down after two injections of collosal iodine when the fifth day has passed, and where it is known or questionable as to whether there is retained membrane in the uterus. The solution used may be cyllin, ʒj to the quart of water, or magnesium sulphate solution, ℥ii to the pint, because of its hygroscopic action. The method of giving an intra-uterine douche in the puerperium is described on p. 549. An intra-uterine douche should not be given before the fifth day of the puerperium. The uterine ostia are still open, and the danger of forcing septic material into the abdomen is great at this period.

While *manual exploration* of the uterus is seldom necessary in the puerperium, the method is described, as it may be indicated occasionally.

Exploration of the uterus. An anaesthetic, preferably ether, will only be needed if the patient is nervous.

For the rest, the treatment is similar to the removal of retained bits of membrane or placenta causing post-partum

haemorrhage. The patient is in the cross-bed position, the vulva cleansed, the bladder emptied, the vagina douched. The half or whole hand is then placed in the vagina, and two fingers in the uterus, which is steadied by the abdominal hand. The fingers in the uterus scrape round the walls and remove any débris which may be present. It has been suggested that some gauze should be placed over the gloved fingers, but this is very seldom possible or necessary. An intra-uterine douche must always be given after exploration.

FIG. 242.—Endometritis, showing layer of leucocytic infiltration (septic case, Rotunda).

a, necrotic decidua; *b*, wall of leucocytic infiltration; *c*, uterine muscle.

Any woman with a temperature above 100° F. should not nurse her baby.

PUTRID ENDOMETRITIS

This is a more advanced local condition than that described above, but the symptoms are so akin that it must be mentioned here. The whole interior of the uterus is shaggy, and a quantity of easily detachable matter can be scraped from any part. The discharge is abundant and offensive. The condition is one of putrid endometritis, which is practically always associated with infection by the bacillus coli. There is usually a thick necrotic mass, and pieces of membrane, placenta, and decidua are present.

Whitridge Williams has drawn attention to the reason

why this type of infection is not virulent. On microscopic examination there will be found a "marked development of the leucocytic zone" (see Fig. 242) beneath the necrotic layer. This acts as a most effective barrier and prevents blood infection, and none is found beyond it. This is very unlike the severe types of sepsis where the leucocytic zone is not developed, and where there is a free path towards the placental wall lymphatics, and peritoneal cavity.

An intra-uterine douche will be indicated in this class of case, in addition to the routine treatment which has already been given for sapraemia.

The Rheinstädter curette. The Rheinstädter curette is only mentioned to be *condemned.* We *never use it now in the puerperium.* It is a dangerous weapon which lights up more infection than it removes.

General infection. We feel it is best to speak of the remaining types of infection with which we have to deal, under this heading. We have already spoken of the mild sepsis which we have grouped under the clinical name of **Local Infection,** and we shall now proceed to deal with (1) **Lymphatic sepsis,** (2) **Venous sepsis.** These, while separated, may occur together. In fact the invasion of the body from the uterus by septic organisms leads to so many clinical conditions that it is impossible to give an accurate description of a typical case.

Symptoms may develop within thirty-six hours of infection, and the patient be dead within another twenty-four hours from overwhelming toxaemia. She may first suffer from local infection, and the septicaemia due to living bacteria in the blood be superadded. Rigors occur, and the general condition of the patient is far worse than is customary with sapraemia. Frequent rigors may occur at fairly definite intervals, and true pyaemia may supervene. Acute endometritis with outpouring of pus, and a large, tender, flabby uterus, is another type of severe puerperal sepsis. Acute inflammation of the pelvic cellular tissue (parametritis), or of the pelvic peritoneum (perimetritis), or the two together, affords clinical pictures. Acute pyosalpinx is another variety, but is usually associated with peri-

metritis and parametritis. Lastly, acute general peritonitis may end the life of the patient.

An infection that presents such a variety of possibilities is difficult to describe concisely. We shall, however, proceed to describe (1) Lymphatic sepsis, next (2) Venous sepsis, after which we shall briefly refer to parametritis, perimetritis, pyosalpinx with the possible formation of a pelvic abscess, or even the dangerous formation of acute general peritonitis.

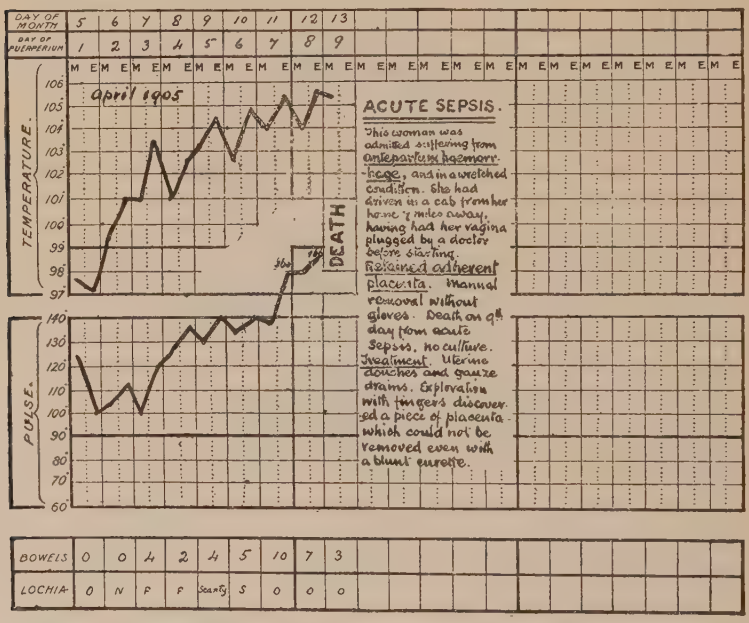


FIG. 243.—Chart of acute sepsis. Death.

This is an old chart showing treatments which are rarely carried out nowadays, such as plugging vagina, douching the uterus, and curetting. See text.

The chief thing to remember is that all or some of these conditions may be associated, and that any of them may be placed on the lesser degrees of infection.

LYMPHATIC SEPSIS

Onset. This arises from *thirty-six to forty-eight hours* after infection. If it occurs before this, it may be taken for granted that the infection occurred before labour—ordinary blood poisoning arising from punctured wounds *may* develop within twenty-four hours.

Symptoms and signs. These are not in any way different from acute blood-poisoning in men, or in non-puerperal women. The attack is most frequently ushered in by a rigor. The temperature as a rule rises above normal, and it is characteristic of the temperature of acute lymphatic sepsis that when once raised it *remains above normal.* In some cases, when the infection is very violent, the temperature shows no response, and may actually be subnormal. With

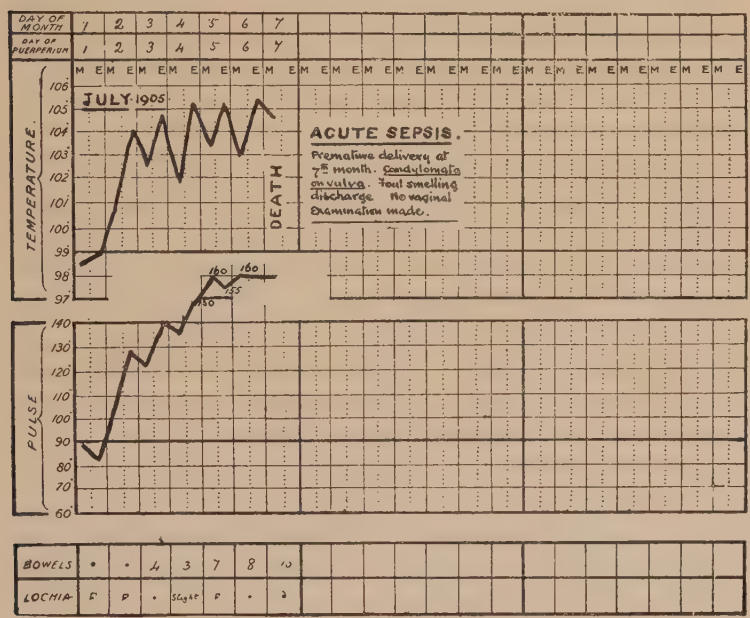


FIG. 244.—Chart of acute sepsis.

or without pyrexia, the other symptoms of a toxic fever appear. The patient has a severe headache, she is thirsty, hot, and flushed. The lochia is much diminished or absent, and typically not foetid. The breasts are unchanged, except that the flow of milk diminishes, or ceases. The tongue, usually at first furred and then dry and brown, may be moist and clean throughout the illness.

Hence, a patient with acute sepsis may present a normal or insignificant temperature, no lochial changes of any note, no breast changes, and a clean, moist tongue—a group of symptoms which is very misleading. But if careful to feel

and count the pulse, there will always be warning of the true condition of the patient. The pulse-rate rises progressively and the beats become feebler, until it is uncountable before the final issue of death. The next most reliable sign of acute lymphatic sepsis is the severe and intractable insomnia, and, thirdly, we attach significance to restlessness. The patient is conscious almost to the last, but she is querulous, unhappy, and apprehensive, instinctively fearing the terrible danger that threatens her.

Diarrhoea with passage of undigested food, distension of the abdomen, and vomiting may all occur without peritonitis. Cutaneous rashes are common. The uterus involutes fairly, and is not tender. On the third or fourth day, if the patient survives, the clinical picture may change. The patient says she feels much better, that she is weakened by lying in bed and would like to get up, or she thinks she would get well if only she could sleep better. But this change from apprehension to hopefulness, known as euphoria, is one dreaded much by the experienced obstetrician. He does not share the delusion of his patient, and knows that when a patient says she is much better, and yet her pulse is faster and more feeble she is sure to die. He sees how her pinched and sallow face, her pale, tremulous lips, and the fine tremor of her hands, belie her hopeful words. In a few hours, or a day or two, she sinks into unconsciousness and dies.

Prognosis. The prognosis is extremely bad, but it is quite impossible to determine definitely the statistics, for these depend on what the observer considers to be lymphatic sepsis. We used to regard the disease as immediately fatal, but we have so many methods of treating the disease now, that there is no need to give up hope in what appears to be the worst type of case. The patient with distended abdomen, absence of lochia, vomiting, diarrhoea, and frequent rigors, and who suffers from insomnia, suggests a really bad prognosis. A rapid running pulse in association makes this worse, but watchful management and careful treatment may prove successful in fighting the disease.

The disease spreads via the lymphatics of the uterine wall to the general peritoneum, and once general peritonitis occurs the outcome is very hopeless.

Post-mortem appearances and treatment. These will be dealt with after we have considered venous sepsis.

VENOUS SEPSIS

This is also called Pyaemia.

Symptoms and signs.

Onset. This usually does not occur for about *ten days* after infection : it may be as late as three weeks. It arises usually through spread in the placental sinuses. These are very numerous. During the removal of a retained or adherent placenta, local infection may occur, or a piece of placenta being left behind may give a chance for bacteria to develop. The venous sinuses are occluded by blood-clots, which are loosened by peptonisation. This peptonisation has to occur before the characteristic symptoms are manifest. For this reason the onset is late. Venous sepsis may arise so late that the doctor may have terminated his attendance, and mistakes in diagnosis may arise in this way. It may follow thrombo-phlebitis of the veins of the lower limb. Rarely it may follow puncture wounds of the veins ; following, for example, the stitching of a perineum, or venous transfusion in a septic manner, has been known to cause the occurrence of pyaemia.

Bacteria. These are the same as those which cause lymphatic sepsis. The haemolytic streptococcus is the most common organism, but staphylococci and other bacteria are found.

The name pyaemia is not so good as acute venous sepsis, for though distal abscesses usually form, they do not invariably do so, and the name acute *venous* sepsis contrasts better with acute *lymphatic* sepsis.

Signs and symptoms. Probably in all cases the onset of pyaemia is preceded by signs of puerperal infection.

The actual onset is sudden. Either before or after the patient has got up from her bed, she feels a sudden chill, her teeth begin to chatter, her lips are blue, and her face is drawn and pinched. Both her temperature and her pulse-rate rise, the former reaching quickly up to 104° or 105°. Then follows a profuse perspiration, and the temperature

and pulse again fall to normal, and the patient feels quite well. She says she has caught cold, but that she went to bed, got into a perspiration, and now feels well. Her temperature and pulse are normal. There seems to be no cause for alarm, and a mistake in diagnosis is easily made. But a few hours later, or the next day, another rigor followed by perspiration gives the true significance of the first. The patient has not caught cold, but she is at the beginning of a severe and frequently fatal illness, acute venous sepsis. The lochia may be foetid, or red lochia may have persisted.

There is a notable difference between the pulse and temperature in this disease and in acute lymphatic sepsis. In the latter, when once the temperature has risen above normal, it remains above normal, and when once the pulse-rate has increased, it continues to become more and more rapid until death. In acute venous sepsis the pulse does not indicate the presence of a dangerous infection. The infection is not a continued infection like acute lymphatic sepsis. The bacteria, and their toxins, are not continually dribbling into the system with the slow lymph stream. Rather it is a spasmodic infection, and the invasion of the system by bacteria is sudden and temporary. It has long been taught that this spasmodic character of acute venous sepsis, with its sudden rigors, is due to the dislodgment of septic thrombi from the veins into the blood stream. It seems highly probable that this is so, for after a rigor a new train of signs often arises. The patient may become paralysed or speechless; she may develop meningitis; she may get a violent stitch in the side, which is followed by pleuritic effusion and empyema; she may get septic pneumonia; she may get severe pain in a joint, followed by purulent arthritis; she may get malignant endocarditis; she may get subcutaneous abscesses (these, it may be added, are of favourable import): in short, there is hardly an organ in the body in which one of these septic emboli may not lodge.

As the disease progresses, the intervals between the rigors become shorter, or the incidence of complications causes a continuous intoxication, and both temperature and pulse-

rate are permanently raised. The patient becomes weaker, and dies as in acute lymphatic sepsis.

In other cases acute venous sepsis takes on a more chronic form. Abscess after abscess forms, and should be opened. The patient is weak, and her face sallow, but after a prolonged and trying illness she finally recovers, though frequently crippled by stiff joints, and a permanent invalid from pelvic disease.

PARAMETRITIS. PERIMETRITIS. PELVIC ABSCESS. GENERAL PERITONITIS.

The future of the patient with regard to child-bearing will depend to a very large extent on what happens in the course of a case of puerperal infection. The infection may remain *localised in the uterus*. It may spread directly to the *general circulation*, when either a fatal result will ensue, or the patient will recover after a very stormy time: in this case the tubes will probably remain unaffected, and within a reasonable period further pregnancy will result. Another type is where the infection spreads to the pelvic connective tissue (*parametritis*) or to the pelvic peritoneum (*peritonitis*). Adhesions follow. The tubes become closed or get bound up in adhesions. Sterility results, which may in ten to fifteen years cure itself, or operative surgery may be required. In other words, while the direct jump to the general circulation is the more dangerous, it leaves less lasting results than the protective peritonitis which closes the tubes.

Salpingitis. We shall only mention the acute variety here: the chronic belongs to gynaecology.

The **symptoms** usually occur some weeks after labour. It is extremely difficult to diagnose. There is a high temperature and pulse-rate. The patient complains of pains in both hypogastria. Bimanual examination reveals thickening in both tubes, with tenderness in the region of the uterus.

Treatment. If the case can be diagnosed, the treatment is either *palliative* or *operative*. We advise palliative measures, *i.e.* with the patient well propped up, hot vaginal douches at a temperature of 110° F. twice daily, abdominal fomentations, in the hope that *resolution* will occur, or else

that the tubes may become adherent and form an *abscess* which can be opened in Douglas's cul-de-sac. The risk is taken in this treatment of the pus *leaking* into the abdominal cavity and causing a *general peritonitis*, but the danger of the operation (salpingectomy) is so great that the risk may be taken. The acute salpingitis may spread to the ovary and cause a salpingo-oophoritis, which will form an abscess or pass into a chronic inflammatory condition. A perimetritis may occur.

The operative treatment, which we do not recommend, except in so far as abscesses should be opened, consists of :

(1) Removal of the tubes.

(2) Opening the tubes, sponging out the pus, stitching the tubes, and closing the abdomen, with or without drainage.

(3) Removal of the uterus, tubes, and ovaries. There is certainly a small field for hysterectomy in the treatment of sepsis. If the uterus remains subinvoluted for seven to ten days, if there is a foetid discharge, if irregularities which suggest abscess can be discerned, or if myomata are present, and in addition the temperature and pulse-rate remain high in spite of treatment, hysterectomy is occasionally indicated. It is difficult to decide on the day when hysterectomy can be no longer postponed, but great care must be taken not to remove the uterus unnecessarily.

Palliative measures recommend themselves to us, and are practised by us, because they are safer, and there is some chance of a cure with organs *in situ*, or of a less dangerous operation later.

Pelvic Abscess. This may follow salpingitis, parametritis, or perimetritis. It usually occurs some weeks after delivery and points most commonly in Douglas's cul-de-sac. Another likely site for abscess pointing is over Poupart's ligament, but an abscess may occasionally be found opening into the obturator foramen or into any of the viscera. Therefore, when a patient has persistent temperature at about two weeks, always examine the *posterior fornix* or over Poupart's ligament for abscess pointing. By the diagnosis of this condition a cure may be obtained where a fatal result would have ensued.

The **treatment** of pelvic abscess consists in opening it.

Fig. 245 shows how an abscess in the cul-de-sac is opened. A bullet forceps is placed on the posterior lip of the cervix, the pus is evacuated and the cavity is douched out with weak cyllin solution: this irrigation is repeated daily until the temperature has fallen and the pus is no longer present.

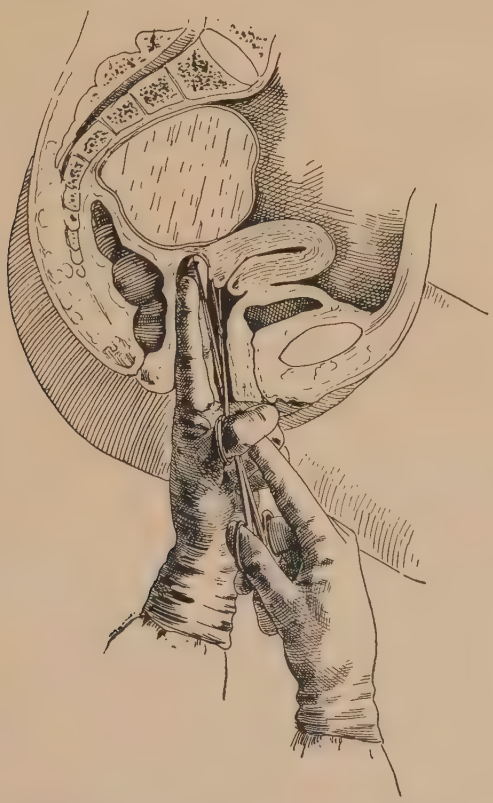


Fig. 245.—Opening a pelvic abscess through the posterior fornix. Another method is to open the abscess by sight after passing a poster or speculum. (From Solomons' *Handbook of Gynaecology.*)

Perimetritis. Inflammation of the pelvic peritoneum. This is a protective agency in which the infection is limited to the pelvis, and the general peritoneal cavity is free.

Symptoms and signs. These occur about two weeks after infection. A sensitive doughy mass is felt in the roof of the pelvis: this consists of the matting together of the intestines by a glandular oedema. Abscess may form and point as described on p. 542.

Parametritis, or pelvic cellulitis, is caused by infection occurring in a lacerated cervix and spreading thence to the cellular tissue.

Symptoms and signs. The inflammation is usually unilateral: the swelling is accompanied by all the symptoms of inflammation—raised temperature, pulse, etc. It is uncommon in the acute stage, and is more frequently found as a chronic condition. The main difference between it and perimetritis is that it is definitely extraperitoneal and raises up the peritoneum in front of it. In this way an abscess may point in many places, the chief of which are over Poupart's ligament, and in the cul-de-sac; an abscess may also be found behind the utero-sacral ligaments, in the abdominal wall between the pubes and the umbilicus, in Scarpa's triangle, in the buttock, in the kidney region.

In addition to these signs and symptoms of the condition as it occurs, it must be stated that during the first week before the main pyrexia is present, there is some rise of temperature and pulse, *i.e.* on an odd day the temperature is 100° F., the lochia is not quite normal, and sub-involution occurs. The real condition is ushered in by high rise of temperature and pulse, rigor, tenderness and rigidity. The patient is ill with signs similar to the better-known symptoms of acute appendicitis, namely, she is very feverish, has bad headache, sickness, and constipation.

A leucocyte count is useful, for a leucocytosis of 18,000 or more may be regarded as good evidence of the presence of pus, if other causes of a leucocytosis are excluded.

Treatment. Take the baby from the breast. Open abscesses where they point. Raise the head of the bed.

General Peritonitis. This does not differ from other kinds of acute general peritonitis either in signs, symptoms, or treatment. The only treatment for this almost hopeless condition is free drainage through the abdominal wall and Douglas's pouch, and continuous rectal irrigation with normal salt solution.

Treatment of Severe Puerperal Sepsis

We have already described the method of setting about the treatment of sapraemia. We shall now consider the

possible methods of dealing with lymphatic and venous sepsis.

The diagnosis is made by the symptoms and signs. It is confirmed by an examination of the swab taken from the uterus, and blood taken from a vein in the arm. The former has been described.

Treatment.

(1) **Prevention.** This has been alluded to already, both with regard to cleanliness in the confinement and the "keeping up" of the strength of the patient in pregnancy. Also the prophylactic treatment of suspicious cases by the injection of serums and collosal iodine.

It may be divided into :

(*a*) Prevention in Pregnancy by treating anaemia, general wasting diseases, etc.

(*b*) Prevention in Labour by observing cleanliness and making no vaginal examinations. Asepsis and care in the management of the third stage of labour.

(*c*) Prevention in the Puerperium by seeing that the patient is washed carefully, that perineal stitches are removed with boiled scissors, that free movements are encouraged. When anaemia is present, that it be treated.

(2) **General.** Keep up the strength of the patient by nourishment. Take the baby off the breast.

(3) **Mechanical.** Favour draining by postural treatment.

(4) **Drugs.**

(*a*) **By the mouth.** Quinine and ergot. Quinine may be given as a routine, in dosage of 5 to 10 grains three times daily, as far as the patient can take it without suffering from cinchonism. It acts as an oxytocic, stimulates the uterus to get rid of lochia, and is an efficient antipyretic.

Ergot has been used by us very largely. We have now given up using all types of ergot except ergotamine tartrate and ergotoxine. We use "femergin" (which is the proprietary name of the former) in tablet and hypodermically. In sepsis, femergin may be given, 1 tablet three times daily, both as a prophylactic, and with the same idea as one gives quinine. Ergotoxine is also given both hypodermically and by the mouth.

Alcohol in various forms has been used. We do not use it at all. It seems to stop the action of vaccines, serums, etc.: in fact it appears to be an added expense without the expected gain. Many years ago, we used to give whisky or brandy eight to ten ounces daily.

Stimulants such as strychnine, digitalin, etc., may be given when the pulse demands them. Haemoglobin in 5 grain capsules, three times daily after meals, or a mixture containing arsenic and iron, should be given to all obviously anaemic patients who are septic.

(*b*) **By injection.** Collosal iodine has been our sheet-anchor for some time past: 20 c.c. are given intravenously each evening until the temperature is subnormal: if the iodine fails after about 100 c.c. some other form of treatment must be tried. Its mode of action is described on p. 520.

Vaccines. These have not done all they promised for the cure of puerperal sepsis. We take a swab, and if there is a growth and the temperature persists, an autogenous vaccine is made and given. In view of some of the excellent results obtained by Dr. Rowlette, late Pathologist to the Rotunda, in many cases, we reprint our views as expressed in the last edition.

Vaccines have proved of value in all forms of puerperal sepsis, whether local or general, but they are to be employed together with, not instead of, whatever surgical or other treatment may be considered advisable. It is necessary that the nature of the infecting organism should be discovered by examination of the lochia taken, with precautions against contamination, from the uterus. In most cases the organism is either the *streptococcus* or the *staphylococcus aureus*. Having detected the organism, a stock vaccine thereof should be at once administered. Meanwhile, a vaccine, made from the strain separated from the patient herself, should be prepared. If the stock vaccine gives satisfactory results, as shown by a reduction of the pulse and temperature to normal, and general improvement in the patient's condition, there is no need to make the auto-vaccine. In the case of streptococcal infections the first dose should be 5,000,000 cocci; in the case of staphylo-

coccal infections, 25,000,000. Further doses are to be given at intervals of forty-eight hours. The usual result is a definite drop in the pulse and temperature, occurring in from twelve to thirty-six hours after the injection. In many cases both pulse and temperature reach normal, and it may be assumed that the dose given was suitable. If, however, the pulse and temperature come down but do not reach normal, the dose given at the second injection should be twice that at the first. A further increase may be necessary, but in no case should one exceed a dose of 20,000,000 streptococci or 100,000,000 staphylococci. The treatment is to be kept up until one dose has been given after pulse and temperature have become normal. The action of streptococcal vaccine is aided by the simultaneous injection of antistreptococcus serum. The latter has its greatest use when given at the beginning of the disease, and the initial dose should be not less than 20 c.c., and may with advantage be as high as 50 c.c.

Serums. The varieties and methods of prescribing the different sera are described on p. 519. Antistreptococcus, puerperal antitoxins, and scarlet fever antitoxin have all been used.

Soda bicarbonate solution has been tried, but its reactions are so varied and unexpected that we have discontinued it.

Quinine. This drug gives startling results in some cases when administered orally in dose from 5 to 10 grains, three times daily. The hydrobromide is probably best, and it is most effective when given in the form of a mixture. It reduces temperature, but whether it acts as a bactericide or on the leucocytes is doubtful. Luker has had good results from intramuscular and intravenous administration, but as he has given large doses of antistreptococcus serum in addition, it is difficult to know which should be given credit for results obtained. His technique is: on the first and second days of the temperature he gives 30 c.c. of serum, on the third day 20 c.c. He has given quinine both intramuscularly and intravenously. Intramuscularly he gives 5 grs. in 1 c.c. of sterile water every day for from six to ten days. The solution must be massaged into the tissues.

When the intravenous method was used, three injections of 5 grains of quinine bi-hydrochloride were given on alternate days.

So far his results have been promising, but we have had no dramatic successes from the method.

Other forms of intravenous treatment. In addition to sodium bicarbonate and quinine, eusol, novarsenobillon and blood have all been tried. *Eusol* has been of little avail and will not be considered. *Novarsenobillon* has had some little success, and may be tried in an intractable case: grm. ·45 is the first dose: at the end of a week ·6 is given, and each week the dose is increased in this proportion as the patient improves: if she does not improve, the treatment is stopped.

Blood transfusion has saved several lives for us at the Rotunda. For a septic patient who has lost much blood, or who shows definite signs of anaemia, this treatment is of definite service. It is necessary sometimes to repeat the treatment several times. In one case of sepsis following placenta praevia, the veins in the forearm were so small that the anterior tibial vein had to be used. There is no doubt that in venous transfusion we have a powerful arm in our defence against the bacteria of sepsis. It can be injected in its ordinary citrated form or in conjunction with dead streptococci. When injected alone, it probably acts by increasing the phagocytic power of the latent leucocytes.

The best method of performing blood transfusion is given on p. 298. For one of the best modern papers on the subject the reader is referred to the paper by Colebrook and Storer in the *Lancet* of December 22 and 29, 1923.

The Treatment of Puerperal Infection by Douching and Surgical Methods.

1. **Vaginal douching.** As a means of treatment this is scarcely ever practised. We believe that the vaginal douche does more harm than good: it is more likely to send infection upwards towards the uterine cavity than to attract bacteria from it. The only *indication* that we believe the vaginal douche has now is parametritis or perimetritis. The woman who two weeks after labour has pyrexia, a fixed retroverted

uterus and pelvis peritonitis is benefited by hot vaginal douches twice daily.

The nurse may be told to give these. In private practice the rubber douche bag (see Fig. 33) is used in conjunction with the crutches (see Fig. 122), or else the nurse may give the douche with the patient sitting on a bedpan (different from the one used for bowels, etc.). The douche should be about 100° F., and cyllin ʒi to the quart should be used.

Intra-uterine douche. Fifteen years ago when a patient got a rise of temperature an intra-uterine douche was given, and was repeated very often. We have very nearly given up the use of the intra-uterine douche in the treatment of sepsis. We never give a douche before the fifth day because we believe the tubes are too open then, and that it is more than possible to carry infection to the general peritoneum. After the fifth day, if there is any question of *retention of secretion*, whether it be blood, or membrane, or placenta, the uterus should be douched and possibly digitally explored, but the douche should *not* be repeated.

How to give an intra-uterine douche in the puerperium. If a swab is to be taken, it, of course, is first done. If no swab is to be taken, the procedure is as follows :— The patient is placed on the crutches, as illustrated, or with her legs over the backs of two chairs, or with her feet on the operator's knees. The external genitals are carefully cleansed, the vagina is douched, and a medium-sized Bozeman's catheter is passed up by touch to the cervix and into the uterus, which is then douched out with the cyllin solution ʒi to the quart at a temperature of 100° F. It is not necessary to insert gauze. The douche can should be high enough above the patient's vulva to allow the fluid to flow (about two feet). There is no danger in the intra-uterine douche when it is not too hot, nor too strong, and when the can is not too high. If too hot, it will damage the tissues : if too strong, it may kill more bacteria, but it will kill the tissues and lower resistance.

The Glycerine treatment. Glycerine has often been used for treatment in the past, but Hobbs has had some excellent results with his technique, which is worthy of description here. We have used it with success on a few

occasions. It is peculiarly suitable when the lochia is scanty or absent, for it produces a flow. Glycerine is apparently harmless to the tissues : it is hygroscopic in action, abstracts lymph from the uterus, and thus produces a powerful bactericidal fluid. In Hobbs's hands it has had good results. A thin rubber tube is introduced into the uterus under strictly aseptic precautions : through this 10 c.c. of a 5 per cent. solution of tincture of iodine in glycerine are injected. The catheter is left in the uterus for about eight hours, and the injections are made daily.

Manual exploration of the uterus. This is but *seldom* indicated, and unless done very gently, does more harm than good. It should only be done when there is practical certainty that something has been left behind which will not come away with the douche. The patient is anaesthetised and the vagina douched. The half hand is inserted in the vagina, and a finger is placed in the uterus, which is controlled by the abdominal hand ; any friable tissue which comes away easily is removed, and an intra-uterine douche given.

The operation, if done at all, must be done gently, or it will do more harm than good.

Curetting. This was done formerly with a Rheinstädter's curette (see Fig. 119), but it is never done now. It is more likely to set up new areas of infection than to effect any real good. In our opinion its use in the puerperium is contraindicated.

Pryor's treatment. This is another form of treatment which had a vogue, but is seldom if ever done now. As examiners still ask about it, the method is described.

In septic patients who have resisted milder treatment, or in seriously septic conditions that have not been favourably influenced by minor measures for two or three days, we strongly advise a method of treatment recommended by Pryor. It is easy to carry out, and can be done at the patient's house.

Put the patient in the cross-bed position. With strict aseptic precautions wash out the uterus and pack it with iodoform gauze. Put in a posterior speculum, pull down the cervix with bullet forceps on the posterior lip, and thus expose the posterior fornix. Incise the mucous membrane

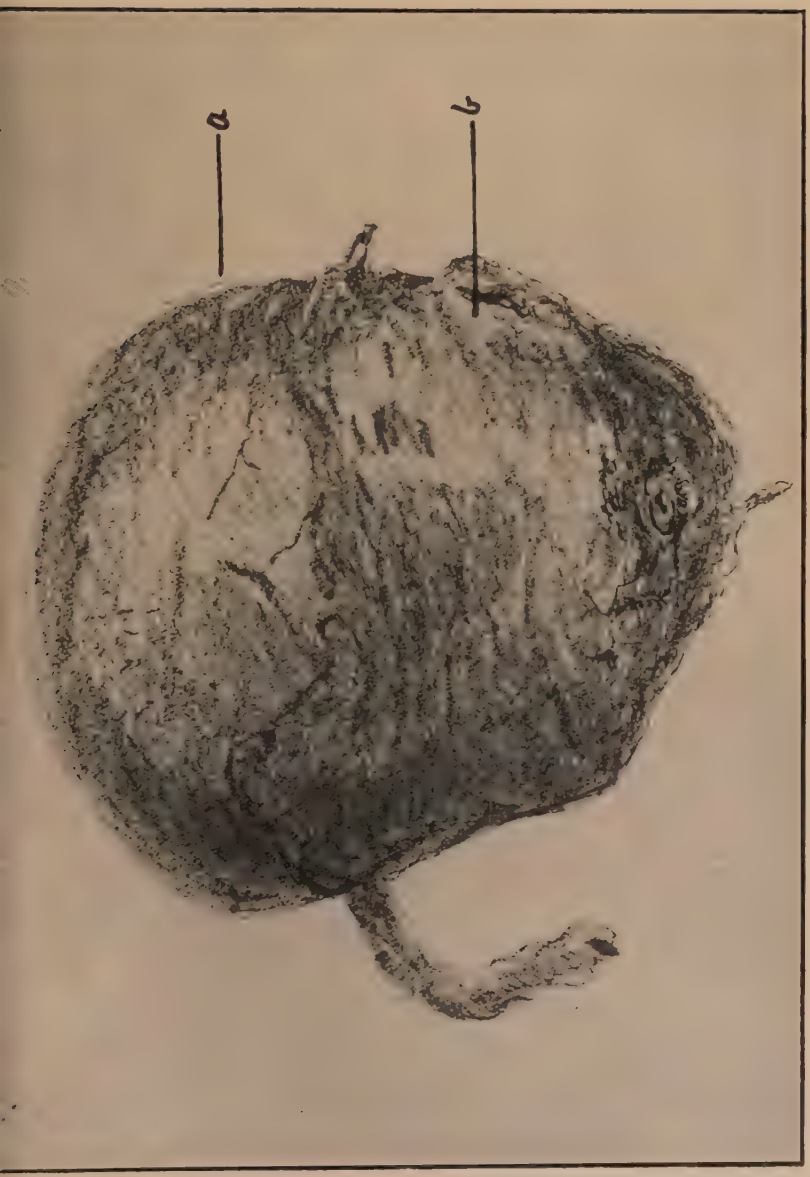


FIG. 246.—Uterus removed for puerperal sepsis. (Rotunda specimen.)
a, gangrenous portion of uterus; *b*, thin line of healthy uterine muscle. The line of demarcation is clearly seen.

of the posterior fornix transversely for about an inch, at the vaginal and cervical junction, which is found by moving the cervix up and down a few times. Insert two fingers into the wound and enlarge by tearing, thus avoiding possible injury to the uterine arteries and ureters. Open the peritoneum with scissors and stitch it to the edge of the wound. This stops haemorrhage and prevents infection of the extra-peritoneal tissues. Leave the sutures long, to control and steady the opening of the wound. Put the patient in the Trendelenburg position, by means of books under the side legs of the bed, if operating at her home. This gets the intestines out of the pelvis, and their place is taken by gauze. Pack Douglas's cul-de-sac with a long strip of iodoform gauze.

Remove the uterine gauze in twenty-four hours, but leave the pelvic gauze for three days. Douglas's pouch is thus drained of stagnant peritoneal fluid, and, more important still, a localised peritonitis is set up, which shuts off infection. The gauze, by irritation, produces a further flow of lymph, and limits the spread of inflammation by fresh adhesions, which are well channelled by lymph passages.

Hysterectomy. The indications for this operation are given on p. 542. We have performed the operation successfully in a few cases, but the number of fatalities is large. The great difficulty is to decide on the day when it is absolutely necessary, that is, when all other treatments have failed, and a fatal result will occur if it is not done. The uterus must not be sacrificed unnecessarily. After removal the abdomen must be drained. If the proper day can be chosen, the results are very favourable. Fig. 246 illustrates a successful case.

Ligation or removal of the ovarian veins. Jellett removed successfully the ovarian veins of a patient in the Rotunda suffering from severe sepsis, and she recovered. The difficulty in deciding on treatment of this kind is to lay down an indication on which to work. A third rigor in a series of rigors is suggested as the indication for active treatment, but patients have recovered without this difficult and dangerous operation even *after* these rigors.

Their presence can be diagnosed bimanually, and they

can be tied either extra-peritoneally by incision alone and parallel to Poupart's ligament, or intra-peritoneally through the ordinary median incision. Bourne suggests that a possible way to get success is to tie the right ovarian vein as high as possible just at its entry into the vena cava behind the duodenum, while the left vein should be tied at its point of entry into the left renal vein. In addition, the internal veins should be tied as near to the internal iliac veins as possible, and a drainage tube should be left in the point of the abscess.

To sum up the treatment of a case of uterine infection. Having excluded everything extra-genital, and puerperal ulcer, a swab is taken from the cervix and from the body of the uterus: 20 c.c. of collosal iodine are given; this is repeated so long as the temperature remains high. Such drugs as femergin and quinine may always be administered orally. If anything grows on culture, an autogenous vaccine should be given. A blood culture should also be taken. If the collosal iodine is not effecting a cure, and there is no vaccine ready, give large doses of antistreptococcus serum or puerperal antitoxin. Be ready with a donor to transfuse blood. The other treatment already suggested may be kept in mind for emergency.

The table on the following page shows the various points in difference between local infection and lymphatic and venous sepsis.

The Prognosis in Puerperal Infection.

The immediate prognosis is often extremely difficult to define. If a patient persists with insomnia, raised pulse-rate and very high temperature, the prognosis is very bad. If she sleeps badly and the pulse-rate *remains* high, the prognosis is bad. If she is sleeping well and the temperature is high but the pulse-rate keeps at a reasonable rate, the prognosis is good. With all these, if her general condition is bad, and there is scantiness or absence of lochia, the future is unsatisfactory.

If the pulse is high and temperature low and she sleeps badly, looks badly, and says she is well, she will surely die. She is in a condition of euphoria, which is usually very fatal.

Different Forms of Infection

	Acute endometritis, formerly known as Sapraemia.	Lymphatic sepsis.	Venous sepsis.
Cause.	Organisms growing on dead tissue, *e.g.* clot, which cause toxaemia. Symptoms from their absorption, *e.g.* Proteus vulgaris, septicus, aerogenes and Strep. putridus.	May spread from sapraemia. Bacteria may cause it.	Does not spread from placental site. From septic thrombo-phlebitis or from such an occurrence as venous transfusion.
Onset. Symptoms.	Third to fifth day. Temperature raised but not *very* high, accompanied by rise of pulse-rate. Dirty tongue.	Thirty-six hours. Rigors. Temperature high and remains high accompanied by pulse-rate. Occasionally in very severe cases no rise of temperature. Headache, thirsty, restless. Tongue may be clean.	Seven to twenty-one days after labour. Rigors with temperature 104—105, with pulse-rate increased. Spasmodic rise of temperature and pulse due to dislodgement of septic thrombi. Sometimes multiple abscesses.
Lochia.	Foetid and plenty.	Not foetid, diminished or absent.	Ditto.
Treatment.	Purges. Collosal iodine. Femergin. Pituitrin. Quinine. Postural treatment.	Collosal iodine. Vaccines. Sera. Antistreptococcus, Puerperal and Scarlatina. Possibly glycerine treatment.	Ditto.
Post-mortem.	Rarely fatal. Uterus large, contains much shaggy tissue and smelly lochia, very rough. *Microscopically.* Leucocytic zone well developed. Bacteria will be present—some pyogenic in addition to saprophytic.	Pus in tubes. Peritonitis. Uterus. Lymphatics invaded with bacteria. No leucocytic barrier. Uterus cavity smooth with streptococci, bacillus coli and (or) gonococcus may be present.	Similar to Lymphatic sepsis.

This sums up to a large extent the prognosis, but every woman is a law unto herself, and occasionally a woman who appears to be improving, suddenly relapses and dies suddenly, while one for whom a death certificate is in readiness, makes great improvement and recovers.

So much for immediate prognosis. We have already dealt with the remote possibilities. We have mentioned the woman with severe sepsis who recovers with a normal pelvis —that is, where the infection has gone straight into the circulation—and we have mentioned the woman who remains with damaged uterus, tubes, etc.

The remote prognosis for the latter is sterility, heavy menstruation, various pelvic pains, backache, lasting invalidism.

Post-mortem appearances in Puerperal Infection.

To Bumm, Döderlein, Garrigues, among foreign obstetricians, and to Williams among English-speaking obstetricians, we owe a great deal for our knowledge of the post-mortem appearances found in cases of puerperal infection, and to them our acknowledgments are due. We have already mentioned the appearance found in a puerperal ulcer, and here we intend only to deal with the signs found in the uterus in the two main types of infection, namely, local uterine inflammation or putrid endometritis, and lymphatic and venous sepsis or septic endometritis.

When the abdomen is opened, the condition is closely allied to that found in other similar conditions. Pus will be found exuding from the tubes and may be present in amount in the general peritoneal cavity; the whole pelvis may be a mass of adhesions.

On examination of the uterus different appearances will be found, depending on the conditions present.

The uterus in acute or putrid endometritis. It is large and flabby. The inner surface is covered by a rough friable tissue which tears easily. There is a good deal of septic fluid present. The lochia is thick, containing shreds of the uterine wall.

Macroscopically. There is a thick necrotic layer with a well-marked leucocytic barrier, and the organisms will be

found confined to the necrotic layer: in other words, in most cases the leucocytic barrier is well marked and prevents the entry of the infection to the general circulation.

The uterus in septic endometritis (lymphatic and venous sepsis). This is very different. Whereas in putrid endometritis the gross conditions are marked, in this there is apparently very little change. The uterine cavity is smooth, with firm wall. There is no shagginess, no lochia.

Microscopically. There is a *thin* layer of necrosed cells mixed with a fibrinous exudate to which may be attributed the unusual smoothness of the walls. There is a very *slight* amount of leucocytic infiltration (see Fig. 242). The victory will obviously be with the bacteria, which have not stopped to feed on any pabulum, but have rapidly invaded the living tissue of the uterus, and will be found in the blood and lymph streams. Streptococci, which are nearly always the offenders, will be found in the leucocytic zone and in the lymph channels.

In considering the two above types of infection, it is easy to visualise an intermediate phase between the two, where there is less destruction of tissue, and where the leucocytic barrier is moderately developed.

Local abscesses may be found in the uterus, also phlebitis in the small vessels, which may spread to the large vessels of the lower limbs.

Cellulitis, general peritonitis, and even cystitis may be present.

There is a condition called "metritis desiccans" which has been better named gangrene of the uterus, in which the infection invades the muscular coats which undergo necrosis. This type of case will respond to hysterectomy when done at the proper time.

PART VI

OBSTETRIC OPERATIONS

CHAPTER XXIII

OBSTETRIC OPERATIONS

In this chapter the operations commonly met with will be described. Some operative procedures are so intimately connected with the reasons for their performance that they have been already considered. Repair of the perineum and cervix and manual removal of the placenta are striking examples (see pp. 170, 481, 487).

Before performing any obstetrical operation the accoucheur must prepare his hands as described on p. 138. In hospital we wear a sterile coat; if possible we do so in private practice, but we believe that such an operation as the application of forceps can be performed in a satisfactory manner without wearing a sterile gown. We use either the cross-bed position or the left lateral, and the correct position will be given in the description of each operation. In hospital we use either a Kocher's sheet, which exposes only the vulva, or else we use a sheet which covers the anus and is brought round the abdomen; in addition to the latter, a sterile sheet is placed across the abdominal wall (see Fig. 247).

If we have these in private practice we are glad, but we believe that it is quite possible to obtain satisfactory asepsis without using any aseptic sheets and taking great care to conduct the case in an aseptic manner. In hospital we sometimes demonstrate this fact to our students.

There are certain operations where anaesthetics are used; others can be performed perfectly well without. This question will be discussed later.

Before all operations the vulvar skin is cleansed, the bladder is emptied, and the vagina douched. It is con-

venient to have the douche can on the left and the table with instruments on the right side. If the douche can is attached to the instrument table the latter is placed on the right.

1. **Cleansing the external genitalia.** The douche is allowed to play by squeezing its end. At the same time the genitalia are washed from above down with swabs

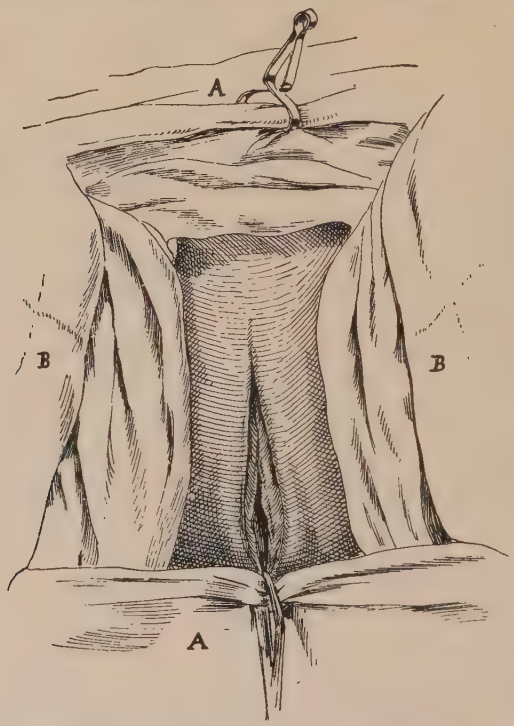


Fig. 247.—Patient prepared for operation. A, sheet brought around abdomen covering anus; B, drawers. (From Solomons' *Handbook of Gynaecology.*)

which have been soaked in 1 in 2000 biniodide of mercury, and which are held in a sponge forceps. A swab once it has been brought down towards the anus must be thrown away. In addition the vulva may then be dried and painted with tincture of iodine or an alcoholic solution of picric acid.

2. **Catheterisation.** An empty bladder is an absolute necessity where it is hoped to attain an accurate diagnosis, and catheterisation should be practised before all obstetrical operations. The urethral orifice should be gently cleansed,

the lips of the vulva should be held apart by two swabs and the catheter passed. In withdrawing, the thumb should be placed over the return flow to prevent soiling of the vulva, which is then cleansed once more.

3. **A vaginal douche** is now given.

An enamel can is used in hospital; a sterile rubber bag in private practice for convenience in carrying. It is placed 2 feet above the vulva, and a boiled glass nozzle is attached to the tubing; there should be a table with a basin of corrosive sublimate or biniodide of mercury solution, 1 in 1000, to hold the end of the tubing and the glass nozzle. Any air is expelled by allowing the fluid to flow before introducing. The latter may be any weak antiseptic, *e.g.* lysol ʒss to the pint, cyllin of the same strength (this must be mixed with cold water before mixing with the hot, as cyllin does not mix well with the latter). The nozzle is introduced into the vagina and two fingers of the other hand smooth out the vaginal rugae and allow the fluid to penetrate thoroughly: the fingers in the vagina prevent fluid being forced into the vagina under pressure, and then possibly into the uterus; in addition a free back flow of fluid is permitted. The nozzle should reach up to the vault of the vagina. About half a gallon of fluid will be required.

Cleansing of the vagina is a necessity before operations. The patients may have been wearing a pessary or there may be pathological organisms present. The vaginal secretion is rendered acid by the lactic acid bacillus especially, and this normally kills bacteria; this then obviates the necessity for routine douching before labour in a normal case.

Before an operation where hands or instruments are being passed upwards, the necessity for removing any possible infective organism is apparent.

The indications for vaginal douching are:

1. In a normal labour where there is any septic discharge, provided the membranes are unruptured.
2. Before an operation.
3. In uterine inertia when associated with rigidity of the cervix.

Anaesthetics. Chloroform is used in labour before all operations except in the presence of the following conditions, when open ether is safer :

1. Toxaemia.
2. Heart or kidney disease.
3. Goitre.
4. Haemorrhages.

The subject of anaesthetics is further considered on p. 154.

Induction of Abortion. This has been described in the chapter on abortion, p. 240.

Induction of labour. In the preceding pages many indications for the induction of labour have been mentioned. They may be summed up as follows :

Non-pregnancy conditions :

Nephritis. Endocarditis. Tuberculosis. Chorea. Diabetes. Pernicious anaemia. Acute infectious fevers.

Pregnancy conditions :

Contracted pelvis. Disproportion. Toxaemia of pregnancy. Hydramnios. Ante-partum haemorrhage. Habitual death of the foetus. Pubiotomy on previous confinement.

The methods used in induction are extremely numerous, and the principal are as follows :

1. Castor oil, quinine pituitrin.
2. Krause's method of catheterisation of the uterus.
3. Sea-tangle tents.
4. Introduction of a hydrostatic bag.
5. Introduction of a stomach tube.
6. Rupture of the membranes.
7. Injection of glycerine between the membranes and the uterine wall.
8. Vaginal douching.
9. Vaginal plugging.

The quinine, castor oil, pituitrin method.—This has the great advantage that when successful there is no internal manipulation. Its disadvantages are that it may induce irregular contractions of the uterus; it has been suggested that it may cause death of the foetus. It is carried out as follows in a typical case :—

Castor oil ℥j is given at 6 a.m. If the bowels have not

moved at 8 a.m., an enema of soap and water is given. At 8.15 quinine hydrobromide grs. 10 is administered : at 10.15 and 1.15 the dose is repeated unless the patient is in labour or there are signs of cinchonism. If labour has not started, pituitrin c.c. $\frac{1}{4}$ is injected; another dose is repeated every quarter-hour until 1 c.c. has been given. If no result is then obtained some other method must be tried. This is very successful when the patient is at or near full term, but it is not so effective otherwise.

Comparison of various methods. We have tried various methods for induction of labour. In the early months, *i.e.* up to the sixth or seventh month, the best method is by the insertion of sea-tangle tents; in the later months Krause's catheterisation of the uterus by means of bougies is indicated. These are the two for first choice, but some of the others have their place in treatment.

The table on the following page sums up the different methods which are considered.

The introduction of tents. This has been described on p. 242.

Krause's Method. Catheterisation of the uterus by bougies.

Indications. Any of the conditions in the list given except hydramnios and ante-partum haemorrhage.

Contraindications. The definite contraindication to the introduction of bougies is the presence of septic discharge. If this be present and induction necessary, some method such as rupture of the membranes must be practised.

There is no absolutely certain method of inducing labour, but this is the most satisfactory. One of its greatest advantages is the fact that an anaesthetic is unnecessary, and as toxaemia is one of the indications and anaesthetics are harmful, the advantage in a method where anaesthetics are unnecessary is great.

In addition there is no danger of haemorrhage from the placental site nor of displacement of the presenting part. While the bougies are placed in the uterus, there is not the great mass of foreign body in the uterus which is necessary in the introduction of hydrostatic dilators or of the stomach tube.

Preparation of bougies. The bougies must be prepared

Methods of Induction of Labour

	Bougies.	Tube.	Tents.	Rupture of membranes.	Hydrostatic bag.	Vaginal douching.	Vaginal plugging.
Anaesthetic.	Unnecessary.	Nearly always necessary.	Unnecessary.	Unnecessary.	Nearly always necessary.	Unnecessary.	Unnecessary.
Intra-uterine manipulation.	Slight.	Too much.	Slight.	Slight.	Too much.	None.	None.
Displacement of presenting part.	None.	Very possible.	None.	None.	Possible.	None.	None.
Start of labour.	Slow, but no interference with mechanism.	Slow, but probably no interference with mechanism.	Slow.	Mechanism may be interfered with.	Slow, but no interference with mechanism.	Slow, but no interference with mechanism.	Slow, but no interference with mechanism.
Repetition.	Occasionally necessary.	Occasionally necessary.	Necessary.	Unnecessary.	—	—	—
Certainty of onset.	About 75 per cent.	About 75 per cent.	Certain.	Certain.	Certain.	Very ineffective.	Certain.
Disadvantages.	(1) Rupture of membranes; (2) very slight danger of sepsis.	(1) Haemorrhage from separation of placenta; (2) rupture of membranes; (3) Sepsis from manipulation.	Slight danger of sepsis.	Prolapse of cord. Interference with mechanism.	Sepsis. The bag may not be ready.	Ineffective.	Sepsis. Manipulation.
Indications.	See text.						

with great care and attention to asepsis. The ordinary gum elastic bougie No. 10 to 12 is used; if there is time it is sterilised by boiling for twenty minutes over-night in 1 in 1000 corrosive sublimate. It is then placed in a basin containing 1 in 2000 corrosive sublimate. If time is not

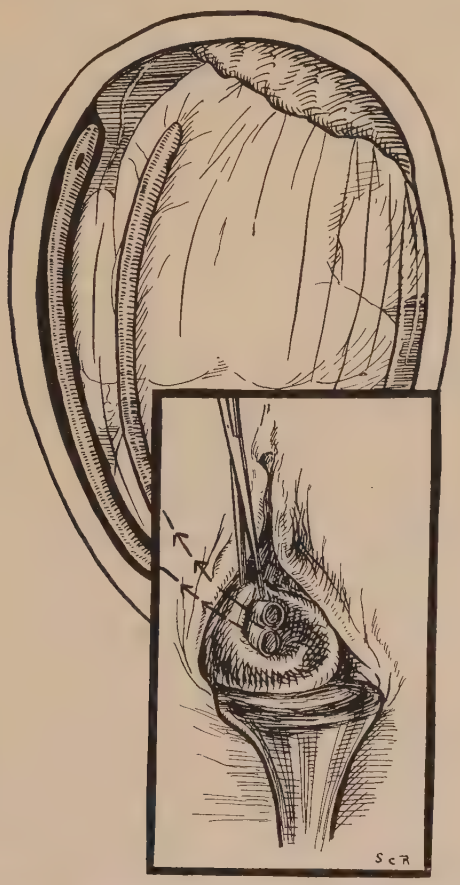


Fig. 248.—Bougies in position between uterine wall and membranes. Lower inset shows cervix exposed with bougies pushed in through os.

available it is boiled for twenty minutes immediately before use.

By this method the bougie is sterilised, and it does not get too hard or too soft. We have also used an aluminium-coated bougie which keeps its shape better, but has the disadvantage of being more expensive.

The operation (see Fig. 248). From two to four bougies are used at an induction. The patient is placed in the cross-bed position. Having been shaved, the external genitalia are cleansed and the vagina is douched. The anterior lip of the cervix is held in a bullet forceps and a posterior speculum is passed. The external os is wiped with sterile wool soaked in corrosive sublimate. The cervical canal is swabbed out with cotton-wool soaked in tincture of iodine or picric acid solution. The first bougie is taken by its proximal end, and without touching the part which enters the uterus is passed *gently* through the cervix and between the membranes and uterine wall; if there is difficulty in its progress, withdraw it and try again. From two to four bougies are thus passed, the number depending on the amount of space. The membranes should not be ruptured during manipulation; if they are, it is a misfortune and further manipulations should cease. Labour will probably follow rupture of the membranes, but the outlook for the child is less favourable. When the bougies are in, pack some iodoform gauze around the ends projecting into the vagina, thus preventing infection from the vagina spreading upwards. The bougies are withdrawn when labour pains are *definite*. Sometimes labour does not start; they should be left *in situ* for thirty-six hours, after which they should be withdrawn. The patient is left alone for twenty-four hours, when, if labour has not started, a new set is inserted. If labour has not started after twenty-four hours, remove them and rupture the membranes. In cases which are dilatory in starting, the castor oil-quinine method of induction should be used in addition. When there is no disproportion, thymophysin or pituitrin in 2-minim doses repeated at half-hour intervals may be tried.

We do not approve of such dangerous procedures as the injection of glycerine or the forcible dilatation of the cervix.

Very often the bougies come down to the vulva once labour has started. We do not allow our patients to walk about, for the bougies will then escape from the uterus.

The introduction of a hydrostatic bag (see Fig. 249). We scarcely ever use this method at the Rotunda. It is used in some clinics as a routine in the treatment of

placenta praevia, with the suggestion that the foetal mortality is less. The great disadvantages are that on the rare occasions when the general practitioner requires it, it may not be ready or it may be out of order. We believe the insertion of a large amount of material into the uterus is a grave disadvantage and may be a precursor of sepsis. In addition to placenta praevia it has been used in cases of inertia with early rupture of the membranes.

There are many varieties of bags, *e.g.* Barnes', Voorhees' and Champetier de Ribes'. The last is most commonly

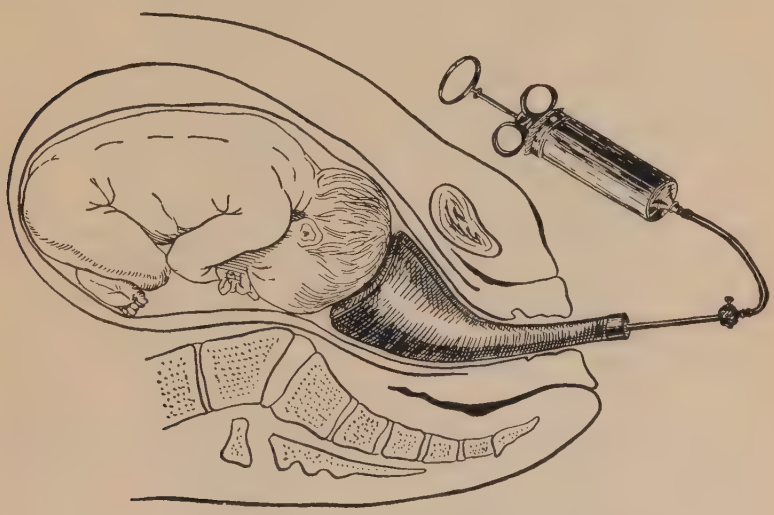


Fig. 249.—Filled Champetier de Ribes' bag in position.

used in this country and is made of waterproof silk. Lowry uses a toy balloon.

The technique in inserting a bag is as follows. Before use, the amount of fluid that the bag will hold must be determined. It is usually about twenty ounces. After a thorough disinfection, a bullet forceps having been placed in the cervix and a posterior speculum passed, the bag is passed up into the uterus. It is then filled with weak antiseptic fluid and the stopcock closed. The end of the tubing is wrapped round with iodoform gauze. Labour sets in and in time expels the bag; if it is slow, a two-pound weight is attached.

The stomach tube. Although we do not use this method at the Rotunda, some obstetricians have had success with it, but we believe that a greater number of organisms are introduced with it, and that there is a danger of displacing the presenting part and causing separation of the placenta. It is not more effective than the bougie method of induction, and is more difficult to perform; an anaesthetic is nearly always necessary.

The tube is No. 20 to 24 and is passed up by the hand after a bullet forceps has been placed on the anterior lip of the cervix and a posterior speculum is passed. It is passed gradually until a coil of tubing is in front of the presenting part. It is removed when the patient is well in labour.

Rupture of the membranes. This always starts labour, but as it interferes with mechanism, the death of the child may result either from prolapse of the cord or interference with oxygen supply. It is specially useful in cases of premature labour when the baby is dead, or in case of toxaemia where instrument methods have failed. Its use is specially indicated from the fifth to the seventh month. It is not always easy to perform.

After preliminary disinfection the half hand is placed in the vagina and a catheter stilette is passed up through the cervix and the membranes are punctured. A tight binder is then applied.

Injection of glycerine is not recommended and will not be described.

Vaginal douching is practically never effective.

Vaginal plugging. It is sometimes necessary to perform this operation, though the number of cases in which it is done now is very small compared with a decade ago.

It may be done in any case of ante-partum haemorrhage, from the early months to term, when the immediate stopping of bleeding is essential. We have had to use it in cases of hydatidiform mole, and it is occasionally necessary in case of accidental haemorrhage. When the cervix admits less than two fingers and the woman is bleeding in a case of placenta praevia, plugging must be done. This can be carried out whether the membranes have ruptured or not.

How to plug the vagina (see Fig. 250). Pledgets of wool about the size of a closed thumb are boiled in a saucepan of water, and lysol is added to make a solution of half an ounce to the gallon. The lysol acts as a lubricant. We carry a jar of prepared and sterile plugs, which are put into a scrubbed and scalded basin with a solution of lysol

FIG. 250.—Diagram of plugged vagina, demonstrating the manner in which the uterine artery can be pressed against the side of the uterus.

of half an ounce to the gallon. A large number of pledgets will be needed, for the vagina is very capacious.

The woman lies in the left lateral position, with her hips projecting over the edge of the bed. Carefully cleanse the hands, the external genitals, the muco-cutaneous surfaces of the labia minora, and douche the vagina. Pass a catheter.

Insert the left hand, with the palm forwards, into the vagina, and, using it as a posterior speculum, both pull

back the perineum and open the orifice of the vagina. The finger-tips of the left hand reach up to the posterior fornix and are able to hold the first plugs in position. Keep the basin with the pledgets of wool on a chair at the right hand. Take one pledget, squeeze it dry, and push it with the fingers of the right hand well home into the posterior fornix. Take another, squeeze it, and push it into one lateral fornix, a third into the other lateral fornix, and a fourth into the anterior fornix. If there is any space between these pledgets, push more in, one by one, until the cervix is firmly and securely ringed by pledgets. This ring round the cervix is the foundation of the vaginal plug. If it is not firm the plug is useless. It is the foremost part of the ram, the effect of which will be explained when the action of the plug is considered. Fill the vagina from above downwards with more squeezed pledgets, tucking an extra pledget where space can be made for it. The stretched vagina is of far greater capacity than one would think, but eventually it will be filled to the orifice of the vulva. Put a pad of scorched gamgee tissue over the vulva, and keep the plug in its place by a firm T bandage with the tail-piece passed between the patient's legs. Then put on a tight binder. Stand on the left side of the patient and pin the binder from above down, inserting the pins transversely with the points buried.

Plugging the vagina, when properly done, will always stop haemorrhage; if bleeding occurs, the operation has not been done properly, and must be repeated. The plugs are left in until labour starts or for a maximum of six hours, when they are removed and the vagina is douched. It will be found that the cervix opens quickly and labour sets in.

How the vaginal plug stops bleeding or induces labour.

(1) Increased intra-uterine pressure.

(2) Pressure by the plug stimulates the cervical ganglion and so excites contractions of the uterus.

(3) Direct pressure on the uterine vessels.

There is no doubt that the plug does stop bleeding, and that it induces labour, and any of the above-named theories

may be true. Hastings Tweedy favours the last and suggests that Fig. 250 illustrates this definitely. There is no doubt whatever that the plug presses upward the lateral fornices like a ram, and that the plug can be felt from the abdomen. It can be demonstrated at Caesarean section that when the vagina is plugged, pulsations of the uterine vessels are not evident to the hand in the abdomen. We are convinced that a perfectly fitting vaginal tampon has the power to control haemorrhage from the uterine vessels. Whether this factor has anything to do with induction of labour we cannot say.

Accouchement forcé. By this is meant forcing open the cervix by dilatation or incision, followed by extraction.

In present-day obstetrics this operation is never indicated

Fig. 251.—Frommer's dilator.

and is never practised at the Rotunda. The different methods employed are :

1. Manual dilatation of the cervix. The whole hand is placed in the vagina and the thumb and index finger are inserted in the cervix with a movement similar in direction to that of snapping the finger. This opens the os, and the second, third, and finally the little finger are successively inserted and by strong flexion the os is forced open. The thumb is used to cause pressure in the opposite direction.

2. Instrumental dilatation by means of Frommer's dilator (see Fig. 251).

This is only suitable in case of abortion, and even then is but rarely used. The method is described on p. 243.

3. Multiple incisions radiating from the os uteri. We performed this operation many years ago, but in each case prolapse of the uterus resulted afterwards : we have discontinued it.

Forceps

The application of forceps at the proper time is a simple matter. When applied at the incorrect time it is a difficult operation, and is usually disastrous to the patient and baby. The physician who familiarises himself with the conditions which must be present before application will never have difficulty provided he has had the training necessary for diagnosis.

The instrument. Various instruments are used in different clinics. We use Barnes's forceps with Neville's axis-tractor. It consists of two blades with handles, which

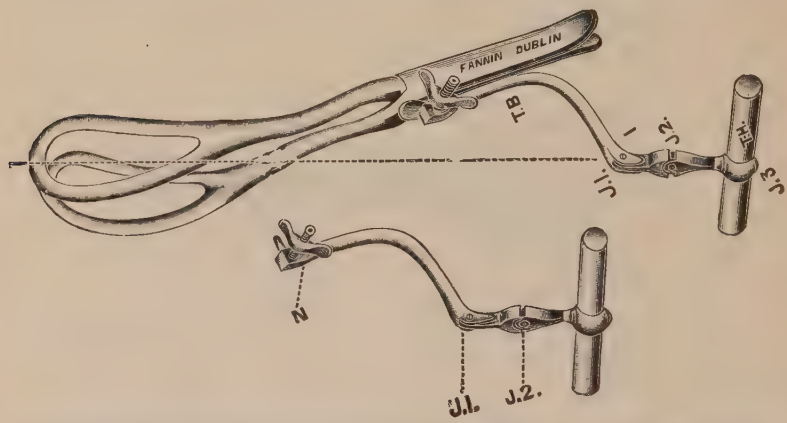


Fig. 252.—Barnes's forceps with Neville's axis tractor. T.B., axis-tractor bar; J,1, joint 1; J.2, joint 2; J.3, joint 3; T.H., handle; N, screw and pin for fixing axis-tractor to forceps.

lock. The best form of lock is the English lock. Each blade has a pelvic and cephalic curve. The blades should not be too springy, too close, nor too far apart, when the forceps is locked. If too close they mark the foetus unnecessarily, if too far apart they slip. Our own forceps measures $\frac{7}{8}$ in. between the tips and $3\frac{1}{4}$ ins. at the greatest width. The instrument and curves are shown in Fig. 252. The curves allow the instrument to be fitted to the pelvis and to the child's head.

Barnes's forceps possesses the following advantages:

1. It is applied as an ordinary long forceps, and the axis-tractor is fitted outside the vulva after the blades have been locked. The complication caused by the presence

of an axis-tractor when the blades are being fitted is avoided.

2. As the axis-tractor is outside the vulva, there are no grooved surfaces or locks, which are difficult to keep clean.

3. When the blades are in position, and the axis-tractor is fitted, they are kept in position. The hands are then freed, if necessary, for giving more chloroform or other purpose, without fear of the blades falling out or shifting.

4. If attention is paid to the arrow-mark on the instrument, one is always sure of pulling in the direction of the axis of the pelvis.

Before considering this subject any further the student must familiarise himself with the instrument. He must be able to recognise the upper from the lower blade and he must be able to lock the axis-tractor.

The best way to recognise the two blades is to place them in position with the convex pelvic curve corresponding to the sacrum, while the concavity looks inwards: at the same time the concavity of the cephalic curve points inwards. The left or lower blade on the Barnes's forceps carries the hook for the axis tractor.

There are four varieties of application of the forceps:

1. *Floating.* When the head is freely movable above the pelvic brim.

2. *High.* When the head is entirely above the ischiatic spines.

3. *Mid.* When the ischiatic spines can just be felt, though the head has descended to them; part of the head, usually the forehead, can still be felt by the abdomen.

4. *Low.* The head is below the ischiatic spines so that they cannot be felt. No portion of the head is felt per abdomen.

Generally speaking most forceps applications will fall under the last heading. We never apply forceps to the floating head, and practically never to the high head. Mid-strait forceps is rare, but is practised occasionally. When forceps are applied to the floating or high head, it means either that they are applied too soon or that there is disproportion without a thorough trial of labour. If patience is exerted it will be found that the head will come low

enough to allow an *easy* application, or else the case is one of such disproportion that some other method of treatment must be tried.

When mid-strait forceps are applied it means usually that there is some disproportion. Occasionally, however, one meets with a case when the head is in the mid-strait and there is apparently no disproportion. These are cases of inertia and the baby may be in danger. One must, however, be suspicious, when one meets a case like this, that there is some misfit between the head and the pelvis, and this must be carefully excluded.

Forceps may be applied by the *pelvic* or *cephalic* method. We nearly always apply them in the former way, *i.e.* to the lateral aspects of the pelvis, no matter where the head lies. It will be found that if the rules given below are observed, the pelvic application will mean that the blades are applied to the sides of the head. In the *cephalic* method the blades are applied to the lateral aspects of the head irrespective of the position of the pelvis; this method, though practically never necessary in the Rotunda, will be described in brief.

Conditions to be fulfilled before forceps delivery. The student is inclined to mix up "conditions" with "indications." Before forceps are applied, *all* the conditions must be fulfilled, but there need be only one indication.

Forceps are not so frequently applied as formerly. When indicated they are invaluable. When not indicated their use may be objectionable and add to the difficulties and dangers of the case.

Forceps delivery is permissible when the following conditions are fulfilled:

1. The os should be fully dilated, so that its rim cannot be felt with a finger in the vagina. Its application before this leads to tears of the cervix, which may result in haemorrhage and sepsis. Later, as a consequence of the cervical tear, there is the risk of uterine prolapse.

2. The head should be fixed in the brim by its largest diameter, *i.e.* the head should be engaged; for instance, in vertex presentation the suboccipito-bregmatic diameter should be through the pelvis; while in brow, forceps is

nearly always impossible, because the greatest diameter (the supra-occipito-mental 12·5 to 13 centimetres) cannot become engaged.

Determine this by the fourth grip of abdominal palpation, by finding that the portion of the child's head is still above the brim. If attempts are made before the largest diameter is fixed, the forceps will probably slip, and much damage will ensue to mother and child.

3. The bladder and rectum should be empty. If they are not empty they may be injured, as they act as direct impediments to delivery.

4. The membranes should be ruptured, otherwise the forceps may slip or the placenta may be pulled on.

5. The head should be fixed in a proper position. Thus anterior parietal presentation or face with the chin behind would be improper positions.

With these primary conditions fulfilled, any sign, either maternal or foetal, which calls for rapid delivery is an indication for the use of forceps.

The following indications for rapid delivery are also indications for forceps when the above conditions are fulfilled.

Indications for Forceps.

A. *Signs of danger to the child.*

1. The foetal heart. Generally speaking, if the rate be below 120 or above 160, danger is present. This suggests foetal distress, more particularly if a slow foetal heart-beat is heard as a sequence to a rapid foetal heart-beat. The heart, however, must be listened to with great care, for sometimes it accelerates during a pain and recovers quickly. In addition to the rate, its consistency and regularity should be noted. If these are at fault combined with slowness or rapidity and other signs of danger, forceps will be urgently required.

The chief warning to utter is not to resort too quickly to forceps because of a *temporary* acceleration of the foetal heart rate.

2. Meconium, unmixed with liquor amnii, is coming away and the head presenting. This suggests that the child's life has been in danger at some time, although not necessarily

at the time when the meconium is seen. It is due either to the child "passing under" or else vomiting faeces.

3. Tumultuous foetal movements noticed by the mother or doctor. These precede death of the foetus.

4. When there is a large caput succedaneum. This shows that the child's head is being subjected to great and prolonged pressure. In addition marked moulding as felt by vaginal examination indicates stress to the foetus.

5. Prolapse of the cord. This is one of the indications when forceps may be applied before all conditions are fulfilled. It has been already referred to (p. 391).

B. *Signs of danger to the mother.*

1. Heart disease or lung disease, acute or chronic, calls for as short a second stage as possible.

2. Typhoid, or other severe fevers.

3. Acute chorea.

4. Atheroma of the blood vessels, with or without paralysis.

5. Accidental or unavoidable haemorrhage.

6. Eclampsia or other Toxaemias.

7. Forceps, or some other mode of rapid delivery, is urgently called for, if there are any signs of threatened rupture of the uterus.

8. Prolonged labour affecting the mother, as shown by a rising temperature and pulse-rate with or without a hot and dry vagina.

A temporary rise of temperature is often due to nervousness and is without significance.

Also, if attempts have been made to apply forceps before conditions are fulfilled, the temperature may be raised. If the patient is allowed to rest, the temperature will subside. The temperature may be present from some cause such as influenza, and this should be excluded so that delivery should not be attempted too soon. Exhaustion due to want of sleep or tardiness from inertia are not indications for forceps. Nor is a slight degree of contracted pelvis, unless other signs arise; nor, again, want of proper flexion of the head. For example, we recently had a primipara

who delivered herself of a full-term child with brow presentation after a second stage of fifteen minutes.

9. If the second stage has lasted longer than two hours in a multipara or longer than four hours in a primigravida, forceps may be applied to save the mother unnecessary suffering, but the head should be low enough to allow an easy forceps delivery, for if humanity is the indication, it is not humane to drag a baby down through the pelvis when watchful expectancy should be the watchword.

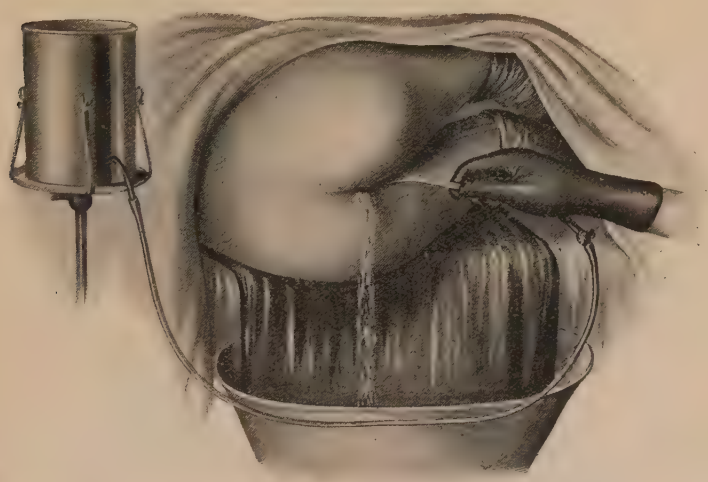


Fig. 253.—Left lateral position of patient for forceps for a vaginal douche. When douching, two fingers of the left hand should be in the vagina.

The Application of the Forceps (see Figs. 253, 254, 255, 256, 257).

In the following description the method adopted at the Rotunda is given. The *pelvic* method is always the choice.

Position. In private practice, when little or no help can be obtained, the left lateral position is the best; as our graduates wish to learn the easiest method for position, we adopt and teach this position. It must be carefully carried out. The patient's back must be parallel to the head of the bed. Her buttocks are well over the edge, her thighs are flexed at a right angle to her body, the legs being extended (see Fig. 253). If the back is not parallel with the head of the bed, it will be awkward to put on forceps. It is

convenient to place a bolster or a pillow against the back. A chair is put opposite the patient's buttocks, for it is easier to apply forceps whilst sitting down and at the right level. There is a mackintosh passing from under the patient and dipping into the bath; a waterproof apron is worn which

Fig. 254.—Applying the lower blade of the forceps.

dips on to the bath and covers the knees. The instruments, namely, forceps, swabs of wool, catheter and vaginal nozzle, are in a tray of warm lysol to the right on a table, or else they may lie on a sterile towel, while the douche bag is attached to a nail in the wall on the left. A bowl containing weak lysol is placed on a table beneath the douche bag; in this bag rest the end of the tubing and the glass nozzle.

The necessity for having the instruments to the right will be apparent when the method of application is followed. During the application the nurse sits on the bed at the patient's back; she supports it, holds up the leg with the right arm, and if necessary continues to drop on chloroform with the other hand.

In hospital, where there is plenty of assistance, the assistant gives the anaesthetic, another holds the leg in the air, while a third sits on the other side to look after the left leg if necessary.

The need of chloroform. It may be taken as an accepted fact that an anaesthetic is necessary if forceps are to be applied in a proper aseptic manner. Except when the patient is suffering from toxaemia or some such condition as cardiac or renal disease, when ether is the choice, chloroform is given. The method we advise in private practice, where there is only a nurse in attendance with the doctor, is as follows: The patient is put in proper position; all instruments are placed as described. She is washed up, catheterised and vaginally douched. She is then anaesthetised, and we then sterilise our hands again, put on gloves and apply the forceps.

If necessary, the nurse, who is sitting at the back of the patient, can drop on chloroform under the strict supervision of the attendant. If the patient's circumstances permit, or if the case is likely to be one of anxiety or difficulty, a special anaesthetist is obtained.

In hospital, or when there is an anaesthetist available as well as the nurse, the patient is got into position and anaesthetised.

The parts are then disinfected and the forceps applied. The amount of anaesthetic must be enough so that the patient will not move about. It should be decreased when delivery is being completed, but she must be kept "under" enough to allow stitching of the perineum.

Preliminaries to application. The external genitals are cleansed, the hands washed and rubber gloves put on, the bladder is emptied and a vaginal douche given. We have given our reasons for douching the vagina. It is most necessary to catheterise the bladder, for it acts as a definite

impediment to delivery and may get pulled down in front of the advancing head, with the result that the attachment between the bladder and the cervix gets torn, and either a definite cystocele results or the patient complains of a certain amount of incontinence on coughing or straining, a condition difficult to combat.

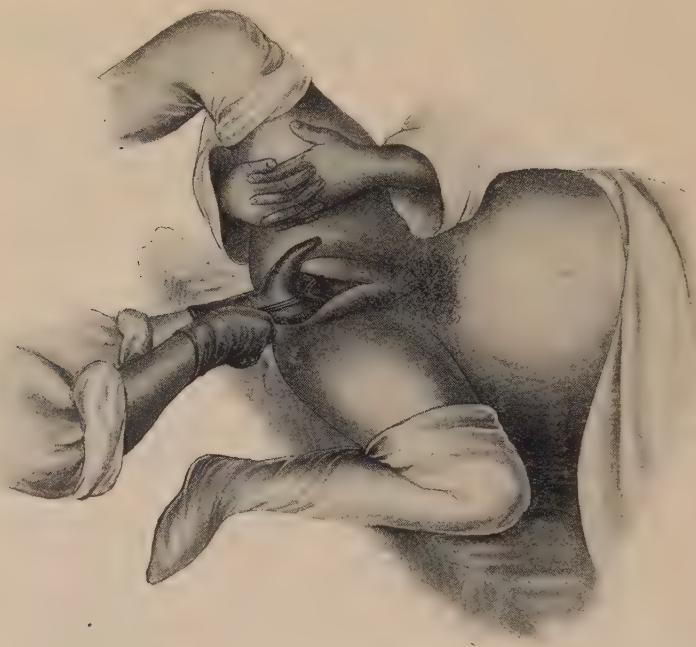


Fig. 255.—The lower blade of the forceps, as a posterior blade, before twisting. (The left leg of the patient should be as in Fig. 254.)

The application. In most cases nowadays we advise ironing out of the vagina. This is a great help in the primigravida before any intra-uterine operation.

Boiled soap is used for lubrication.

The finger of the left hand is passed high up into the vagina, and is drawn downwards and outwards, exerting gentle but firm pressure outwards towards the vulva; the second finger now takes part in the ironing, and the other fingers until the half hand is inserted. *The fingers, once placed in the vagina, are not withdrawn*, and when the half hand is inserted, a careful examination of the cervix is

made to ensure that the membranes are ruptured, the os fully dilated and the head fixed by its largest diameter in the brim. The back of the half hand is now turned towards the hollow of the sacrum as high as possible. It performs two functions: (1) it opens the vagina like a posterior speculum and presses the perineum back; (2) it forms an intelligent posterior pelvic wall aware of the progress and position of the blade and of any obstruction to its progress such as a hand by the side of the head or a projecting promontory.

Take the lower or left blade in the right hand firmly, like a sword (not like a pen), and direct its upper part at right angles *into* the palm of the hand in the vagina. Direct the blade, in fact, as if desirous to push it through the hand into the rectum. Then run the blade up along the hand, keeping its upper end pressed into the palm so as to prevent it striking on the foetal head. Pass it as high as possible, burying it, so to speak, in the vagina, with its cephalic curve in apposition to the palm and fingers of the hand in the vagina, and its concavity looking forwards.

Make no attempt to turn it into its lateral position until it has reached the highest point possible. If the head is high up in the pelvic cavity, it will be necessary in the latter part of the blade's ascent to press the handle well back against the perineum. This enables the blade to ride up along the sacrum until its upper part reaches a little above the sacral promontory. The blade is now sufficiently high. It lies all along the sacral curve, its upper part a little above the sacral promontory. It is, in fact, a posterior blade.

To make it take a lateral pelvic position, that is, to make it the lower blade, when the patient lies on the left side, simply twist the handle outside the vulva, so that the surface of the handle which looked forward now looks upward. The blade in the vagina follows this twist, and the concavity of its cephalic curve, which looked forward, now looks upward. This is its proper position.

If it does not do so, the fingers in the vagina feel for and discover the reason. Common causes for this are that the blade is stopped from full ascent by a projecting sacral promontory, as in flattened pelvis, or is prevented from

turning by catching in a fold in the scalp or an overlapping suture. In these cases make the hand in the vagina direct its progress over the promontory, or away from any other obstruction. If this is impossible, and the forceps will not slip right up as a posterior blade, turn it and let it make the rest of the ascent as a lateral blade, which it will readily

Fig. 256.—Passing the upper blade of the forceps.
(The left leg of the patient should be as in Fig. 254.)

do. In short, the hand in the vagina will indicate what is wrong, and a little ingenuity will set matters right. When the lower blade is in the right position, the handle is pressed well against the perineum. Keep it in this position by putting the shank under the ulnar edge of the hand in the vagina. This enables an important rule to be followed, namely, to introduce the upper blade above and in front of the lower blade. If the upper blade is passed behind

and below the lower shank, hopeless confusion results. *Do not remove the hand from the vagina.* It keeps the lower blade in position, prevents its slipping about—and is just as useful for passing the upper blade as the lower.

Passing the upper or right blade. Pass the upper blade at first precisely as the lower blade, that is to say, make it a posterior blade. When the upper part reaches a little above the sacrum—in other words, when it is buried

Fig. 257.—Locking the forceps.
(The left leg of the patient should be as in Fig. 254.)

up to the handle in the vagina, with the handle pressed well back against the perineum—change it to an upper blade by twisting its handle outside the vagina, so that the surface which looked forward now looks downward. The blade in the vagina follows this movement, and the cephalic curve, which looked forward, now looks downward. If any difficulty arises in turning the blade, deal with it precisely as with the lower blade; to press the blade away from the foetal head, lower the handle a little while twisting it.

Locking the forceps. The two blades are lining the

lateral pelvic walls with the foetal head between them. Now lock the forceps. Hold the upper blade in position with the right hand. Withdraw the left hand from the vagina, keeping its ulnar edge deliberately pressed down on the shank of the lower blade to prevent it shifting from its position. Catch the handle of the lower, or left, blade with the left hand as soon as the hand is withdrawn.

The English lock is locked in the following manner: The two flat surfaces of the handles of the forceps are facing each other. They have to be brought into apposition. Pass the handle of the upper blade down in front of, then underneath, and finally up to the handle of the lower blade. The method of locking is then obvious, and should result naturally.

If they do not lock, twist the handle of the blade that seems out of place, but do not use force. If this is unavailing, pass the left hand again into the vagina and direct one or both blades into the lateral pelvic position. It is not necessary to withdraw the blades and reapply them. Now fit the Neville axis-tractor, and the blades are held safely in position and cannot fall apart.

The axis tractor is useful to the novice, for it tells him the direction to pull; there is no need for the experienced obstetrician to use the tractor at all, for if he follows the axis of the pelvis he can exert the correct amount of force and will do no damage.

How to pull. Generally speaking there is little need to pull very hard, for the perineum is the most usual situation of the head when forceps are applied. It is unwise for the patient to be deeply under the anaesthetic, as too much anaesthesia tends to interfere with uterine contractions and there may be serious post-partum haemorrhage. The nurse sits between the back of the patient and the head of the bed. She clasps the right thigh with her hands in a firm grasp, and whilst traction is made she forms a counter-resistance.

Hold the handle of the axis-tractor and carefully watch the arrow and indicator to see that the traction is in the right direction. If the forceps is slipping it is easily recognised. Put two fingers of one hand on the head and pull

the axis-tractor handle with the other hand. If the blades are slipping there will be no advance of the head with the forceps. Unlock and push the blades up higher, or else reapply them.

In pulling, use sufficient force to bring the child gradually down, but do not use brute force; in other words, if there is apparently bony resistance, desist from the operation, and decide whether it is better to wait a little longer or to perform pubiotomy. The traction should be intermittent, simulating as closely as possible the natural pains. The blades should be loosened when not pulling. This prevents prolonged and continuous traction on the child's head, which may end in cerebral haemorrhage. If there is difficulty in extraction with the patient in the left lateral position, bring her across the bed and endeavour to deliver her in the Walcher position.

If this is unsuccessful, attempts at delivery should cease. The above applies to the case when the head is not on the perineum. *When the head is on the perineum*, the axis tractor is unnecessary.

When the head is brought to the perineum, the axis-tractor is taken off. The delivery can be effected in two ways: (1) the operator stands up, passes his left hand between the patient's thighs, or, (2) he delivers in the position he starts in. We now favour the latter method.

Direct the progress of the head. If it advances too quickly, press the forceps back; if too slowly, pull gently, directing the handles up towards the woman's abdomen. When the head is actually stretching the vulva the mother sometimes "breathes it out," the head advancing with each inspiration. Nothing could be better than this, for the more deliberately and gradually the head advances, the more perfectly does the perineum roll back over the head, and rupture is thereby lessened or avoided. During this last stage delivery can be greatly facilitated by pressing with swabs held in the right hand behind the anus and in front of the coccyx.

When the head is born. Remove the forceps and manage the rest of delivery as in normal labour. Sometimes the child's face is white, the pallor of white asphyxia. When

this is the case deliver at once. After delivery of the child, provided it is all right, hold open the perineum, and, if it is torn, stitch it before the patient comes round from the chloroform.

As in all cases in which chloroform has been given for some time, the third stage is likely to be prolonged. Provided the woman does not bleed, and has no shock, there is no harm in allowing the uterus two hours to expel the placenta into the vagina.

Dangers to the child. Over and above the occurrence of asphyxia neonatorum, a difficult forceps delivery is not without danger to the child. The cord may be compressed by the blades of the forceps. Meningeal haemorrhage may occur and lead to convulsions and death. Idiocy or some form of birth palsy may follow. Deformities or indentations of the skull as a rule pass away in a few days.

Depressed fractures are more serious. Professor Munro Kerr has practised with success a simple method of restoring a depressed fracture. He places the child's head between his knees and compresses it in a direction opposite to that in which the long axis of the fracture lies. In this way the fracture is forced out. We have succeeded in doing this on artificially produced depressed fractures in dead children, but not in a live child, probably because we have not used enough force.

On the other hand, success has uniformly attended the following safe and simple method. The sharp point of one of the blades of a bullet forceps is bored through the bone at the centre of the fracture. The point must be sharp, otherwise the depression is increased. The shank is then turned at right angles to the bone, and the depressed fracture pulled steadily into position. This can be performed safely up to the end of the first year at least.

Facial paralysis may result. It recovers commonly in a few days. If it persists, it must be treated by electricity.

Other positions for and methods of delivery.

1. **The cross-bed position.** This is not favoured by us in our ordinary routine cases because the lateral position is

so much easier in private practice. When, however, the delivery is likely to be difficult, when it is likely that Walcher's position may be necessary, when it is decided to use the cephalic instead of the pelvic method of delivery, then the cross-bed position is indicated. If this position be used, two assistants are necessary, for the case is difficult and the plans of putting the legs over chairs or using any improvised crutch are not satisfactory.

2. **The cephalic method of delivery.** In the above description of applying forceps, we have taken no notice of the position of the foetal head. The best position of the forceps on the foetal head is when each blade fits over an ear. Fortunately this is usually the case, for the occiput rotates to the front. If the head has not rotated properly the foetal face is turned to one lateral pelvic wall, the occiput to the other. The consequence is that by our method one blade fits over the eye and the other behind the ear. Many obstetricians object to this, and in these cases make one blade anterior, the other posterior, so that again each blade encloses an ear. The shape of the forceps is not readily adapted to this position and vaginal lacerations are consequently more liable to occur. It is also a more difficult procedure, and we do not think that the advantages compensate for the increased difficulty in application. However, in certain cases of flattened pelvis, where the head is fixing abnormally, it may be desirable, or even necessary, to adopt the so-called "cephalic" method of applying forceps. In these instances one finds that the occiput is directed to one extremity of the transverse diameter, and the face to the other, hence in the "pelvic" method there may be some difficulty in locking the blades. Under these circumstances the child's ears are carefully palpated, and a blade of the forceps is applied over each, without regard to their position in the maternal pelvis; it is advisable, however, to take one precaution, namely, to have the pelvic curve of the forceps towards the occiput, so that when the latter rotates to the front, prior to delivery, the blades will be in correct position with regard to the pelvis, and not back to front. Should they be found to be back to front when the head rotates, the blades will have to be taken off

and reapplied correctly, the nurse keeping the head pressed down into the pelvis while this is being done.

3. **Forceps with an unrotated head.** This may be delivered as a persistent occipito-posterior, when there will be an extensive tear of the perineum and probably of the vagina. If possible, deliver as follows: Apply forceps as already directed. With descent of the head rotation occurs, and the blades from being lateral tend to rotate to the front and back. These positions are unfavourable for delivery, as the blades stretch and tend to rupture the vulvar orifice, therefore reapply.

First get the nurse to press from the abdomen down into the pelvis on the head and maintain this pressure whilst the forceps is reapplied. Unless she does this, the head slips back again and resumes its unrotated position; the accomplishment of which facilitates delivery. We desire to emphasise this point, for we have seen forceps cases in which it was quite impossible to deliver until the sagittal suture was manipulated into the conjugate diameter of the brim.

The Kielland forceps. The forceps of Kielland and of Barton are very similar. They are very popular in some parts of the Continent and America. We have seen them used, have used them and have studied their use generally. We have not adopted them at the Rotunda Hospital. Their chief indication is in rotation of the head. They are used as high forceps. We do not recommend them because we believe that most of the cases in which they are used while the head is high would come through by the natural efforts of the patient. We believe they will encourage meddlesome midwifery, and especially that they will induce the unskilled worker to apply forceps before conditions are fulfilled. We are not describing them in this work. If the obstetrician wishes to study their use we must refer him to the articles on the subject in the medical journals.

VERSION

By version is meant the turning of the child from one presentation to another. It can be done from about the fourth month onwards, and the method is much the same

irrespective of the period of pregnancy. In considering the subject we shall deal with it as occurring from viability, that is, from the seventh month onwards.

Varieties.

1. External.
2. Combined.
3. Internal.

Combined with any of these must be described the pole which is brought into the pelvis. Depending on whether it is the head or the breech it is known as (*a*) Cephalic; (*b*) Podalic. So that we may describe external combined and internal cephalic or podalic version.

External Version. In these days of ante-natal supervision the opportunity to perform external version has increased, and it may be done in pregnancy or labour. There is but little use in attempting it before the thirty-sixth week, and even then the malpresentation is apt to recur; if so, there is no use repeating the operation until the patient is in labour.

Conditions present. In order to perform external version the abdominal walls must be lax; if they are not loose enough an anaesthetic is given. The bladder and rectum must be empty. The membranes must be unruptured or just ruptured. The presenting part must be unfixed. The foetus should not be in too extended an attitude, for difficulty will be experienced by reason of the fact that the length of the foetus is too great.

Indications. Malpresentation, such as breech, brow, transverse face (see chapters on these presentations).

Contraindications. (*a*) Threatened signs of rupture of the uterus (see p. 419).

(*b*) Marked extension of the body.

Operation. This is a simple matter sometimes, and at other times it is difficult if not impossible. In transverse presentation the head or the breech should be brought over the superior strait by the shortest route; if this is found to be difficult the longer route should be taken. To turn from one pole to the other—for example, to turn a brow to a breech or a breech to a vertex—press on one pole with the upper hand while the lower pole is pressed in the opposite

direction with the other hand. It is a good rule for the operator to follow in performing external version to press on the back, pushing it away from him.

External version is usually successful once labour has started, because the contractions of the uterus will keep the presenting pole in place. It must be remembered that while it is worth while trying in pregnancy, the malpresentation may recur.

Combined version. In this operation the child is turned by combined manipulation of the hand on the abdomen and the hand in the vagina.

A combined version may be bipolar (*one* pole is changed to another), *i.e.* breech to head or head to breech, or it may be a combined cephalic or podalic, depending on whether the head or the breech is made to present from, for example, transverse presentation.

Conditions present.

1. Lax abdominal walls.
2. Cervix admits two fingers.
3. Membranes unruptured or just ruptured.
4. Presenting part unfixed.
5. No contraindications, *i.e.* signs of threatened rupture must not be present (see p. 419).
6. The bladder and rectum must be empty.

If the cervix does not admit two fingers, combined version is practically impossible, although rarely it is possible to push a limb through a one-finger os. If the membranes are long ruptured, the presenting part will not slide around easily, and if this is accompanied by signs of threatened rupture it will be dangerous.

Indications.

1. Placenta praevia.
2. Flat pelvis.
3. Malpresentations of the child; for example, breech occasionally, transverse face, brow compound presentations.
4. Prolapse of the cord.
5. Foetal abnormalities, *e.g.* Hydrocephalus.

Of these the first is the most usual indication. We do not advise version for contracted pelvis except in the rare

instance when there is a history of a previous successful version. Malpresentations and the other foetal indications have already been dealt with.

We shall first describe a bipolar podalic version. This is also known as Braxton-Hicks version, as he was the first to describe it.

How to perform Bipolar Version. All conditions for version being fulfilled, give the patient an anaesthetic; ether is safest in case of haemorrhage. Ascertain the lie of the child. There are several ways of performing bipolar version through a two-finger os.

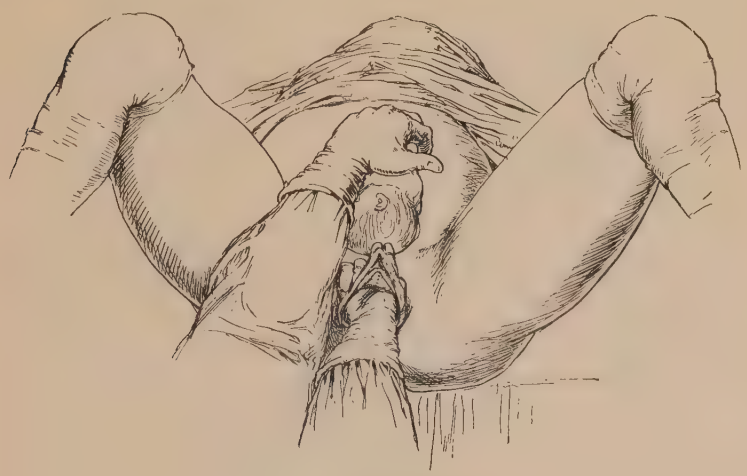


Fig. 258.—Bipolar version.

(*a*) Do external version first, then rupture the membranes and bring down a foot.

(*b*) Rupture the membranes, do version and bring down a foot.

(*c*) Do version, rupture the membranes and bring down a foot.

We prefer (*b*). We rupture the membranes and immediately slip up the head in the direction of the back; while the external hand directs the head towards the pelvis, the fingers catch the foot and draw it through the cervix. (*a*) has the disadvantage that in case of haemorrhage bleeding may commence after version and continue while

the uterine manipulations are being started. (*c*) has the disadvantage that the sequence of events may be lost through difficulty in penetrating tough membranes.

The operation is then performed as follows (see Fig. 258). The patient is put in a cross-bed position, the external genitals are cleansed, the bladder is emptied and the vagina douched. The whole hand is placed in the vagina and the two fingers in the cervix. The hand in the vagina also acts as an efficient cork to prevent the liquor amnii from escaping too early. The membranes are ruptured, the head is pushed upwards in the direction of the back of the child. At the same time, with a hand on the fundus press the child's breech over in the opposite direction. By gentle pushes the child lies transversely. Press down on the breech and feel for the foot with the vaginal fingers. Either foot will do. It is drawn through the cervix and a piece of iodoform gauze placed around the ankle.

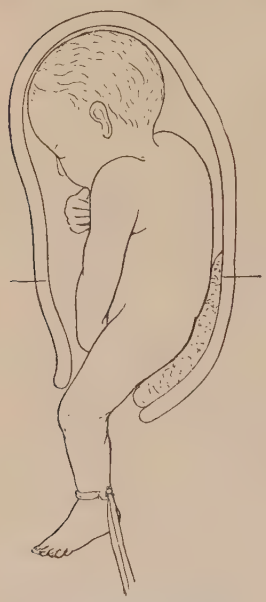


Fig. 259.—The foetus turned in placenta praevia.

The above applies to all cases except central placenta praevia. There are two difficulties met with then—(1) the placenta has to be perforated, (2) the cervix is as soft as wet blotting-paper.

To go through the placenta get a fine-pointed plugging forceps, and push it up to the placenta with two fingers. It is then passed through and an opening is made just large enough to admit the foot. This injures the placenta very little, saves much separation, and thus interferes but little with the oxygen supply.

We have shown above how to bring the foot down. Fig. 259 shows the position of the foetus after version. When, however, the foot can only be just drawn down to the cervix with the tips of the fingers, a bullet forceps (see Fig. 260) must be passed up; this grasps the foot, which is

now drawn downwards through the cervix with the forceps. On no account must more than two fingers be passed through the internal os, because rupture of the cervix, which is like wet blotting-paper, will result in severe haemorrhage.

Which hand should be used in doing bipolar version? This is not so important to decide as when internal version is done. To most people it is a matter of indifference. We prefer to use the hand opposite to those of the limbs, *i.e.* to use the right hand when the limbs are to the right of the mother.

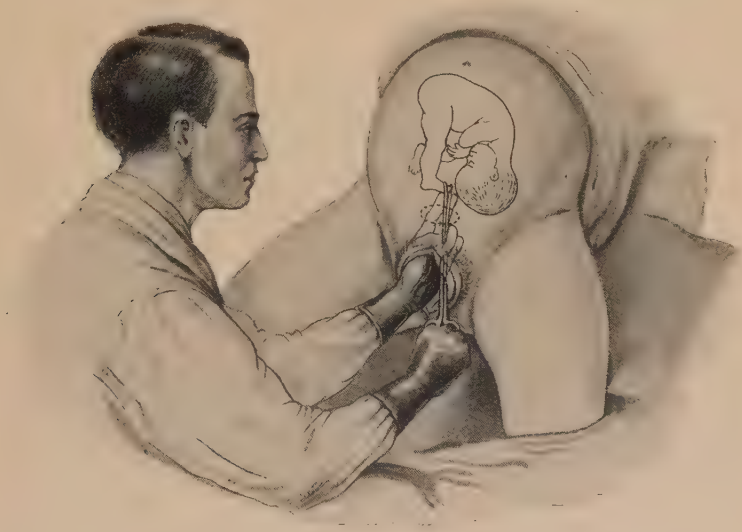


Fig. 260.—Catching the foot with bullet forceps.

It is necessary to know how to *distinguish foetal parts.* The best way to do this is to become accustomed to the parts of a baby when born; it will then be easy to distinguish them when making a vaginal examination.

To recognise the knee from the elbow. The tuberosity of the tibia is the distinctive point, while the sharp olecranon process is felt in the elbow.

To recognise the shoulder. The acromion process, the ribs, and the spine of the scapula are the landmarks.

To recognise a foot from the hand. The straight row of the toes as compared with the separate thumb is not

difficult to make out. Again, the heel and the ankle are quite distinctive. Also a thumb can be folded across the palm of the hand, and a great toe cannot be folded across the sole of the foot, while the dorsum of the foot is very noteworthy.

Internal Version.

By internal version is meant that the os is large enough to admit the whole hand into the uterus, but the other hand on the abdomen assists in the manipulation of turning the foetus.

Conditions present.

1. Lax abdominal walls.
2. Cervix admits the whole hand.
3. Membranes unruptured or just ruptured.
4. Presenting part unfixed.
5. No contraindication (see p. 419).
6. Bladder and rectum empty.

Indications and contraindications. Same as for combined version.

How to perform Internal Version. Version must be distinguished from version *and* extraction. Whether extraction is performed after version depends on the individual case, *e.g.* when internal version is done for prolapse of the cord with the cervix fully dilated the delivery is nearly always completed. When it is done for transverse presentation it is often left to nature. In doing version the accoucheur aims either at bringing down one foot or two feet.

To do version by bringing down two feet. Whether it be a polar or a transverse lie, the foetus is pushed away in the direction of the back. To illustrate the operation in the case of a head presentation with the back to the left.

The patient is anaesthetised and all aseptic precautions are taken, the bladder and rectum are empty. The left hand is then passed into the vagina, which is ironed out in the way already described (see p. 578).

The flat hand is then passed up between the membranes and the uterine wall. After the former have been slightly

separated they are ruptured. The anterior leg is first found, and the two are caught between the first two fingers. If the two feet are entangled the anterior foot is brought down first. In the meantime the outside hand draws the head upwards in the direction of the back, and the breech is left with both feet outside the vulva, provided immediate extraction is not to be carried out.

To do version by bringing down one foot (see Figs. 261, 262). The same steps are carried out until the foot is

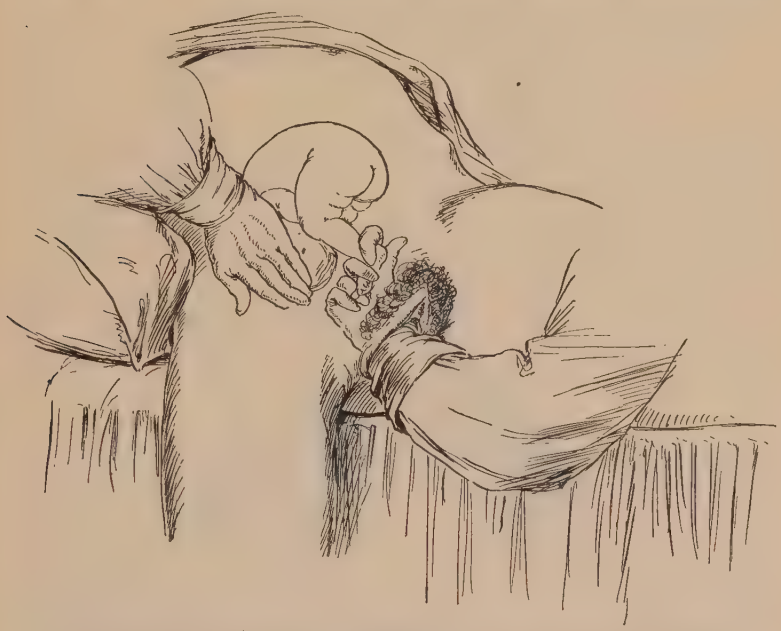


Fig. 261.—Internal version. Catching the foot. The exterior hand draws up the head.

grasped. The anterior is sought for because it is believed that if the posterior is brought down, the anterior buttock may over-ride the pubes; this, we believe, is a fallacy, and certainly in a difficult version the operator is glad to get any foot, the head is brought upwards with the abdominal hand, and the half breech is left in the lower uterine segment where delivery is not being completed.

When the presentation is transverse, internal version is necessarily a simple matter. The head is pushed upwards with the abdominal hand, while the hand in the vagina brings

down the leg. The operation may be extremely difficult if the back is behind and points towards the vulva. In that case the easiest plan to adopt is to bring the head right across the pelvis over to the other side of the abdomen. This brings the limbs pointing downwards and a foot or two feet may be easily seized.

The method of extraction in the case of one-foot and two-feet delivery will be described.

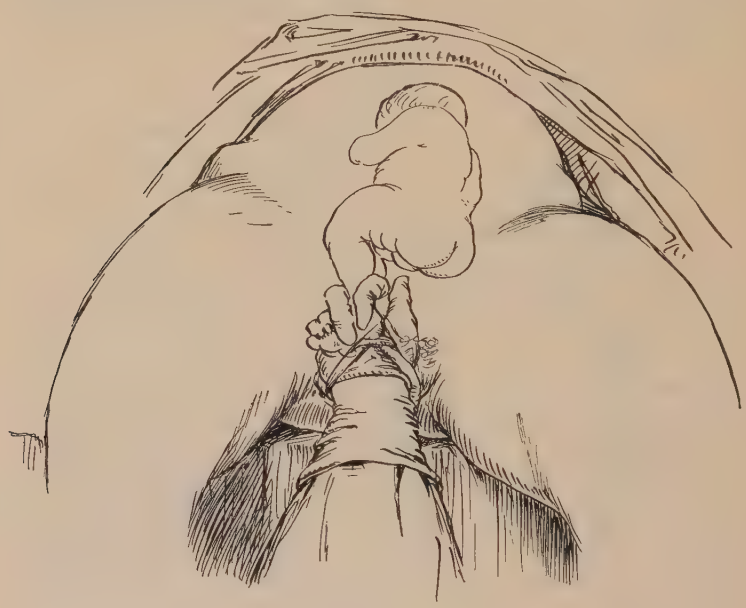


Fig. 262.—Internal version. Bringing down the foot.

Extraction when two feet have been caught. The following method is modified from that of Potter. Gentle traction is made until the knees are exposed. Then pull upon the anterior foot until the pelvis of the child comes into view, when it will be seen that the pelvis is rotated in the opposite direction, that is, with the back posterior. This rotation is brought about by the traction on the lower leg. There is no need to bother about the cord if it is loose; if it is tight it should be clamped and cut.

The body now rotates so that the shoulders will lie in the antero-posterior diameter. The body is drawn downwards and backwards until the lower angle of the scapula is

delivered; with it will probably come the anterior arm; if not it will be found that it is extended; in that case the body is held downwards and forwards and the posterior arm is delivered as already described for breech presentation (see p. 366); the anterior arm is then delivered either as an anterior arm or after twisting the body to make it a posterior arm (see p. 366).

Sometimes it is difficult to get hold of a foot, and two manœuvres can be tried. The first is to push downwards from the abdomen, the second is to pass a couple of fingers into the bend of the knee in order to flex the leg and bring the foot lower.

To extract the breech by traction on one foot. The foot is held as illustrated and traction is made first in the axis of the inlet, then in the axis of the outlet. When one buttock is born, the leg is drawn upwards and the other leg will soon be delivered. If there is any difficulty a finger is passed into the groin and the leg drawn down. Abdominal pressure is, and should always be used. The rest of the delivery is as described when traction is made on two feet.

CAESAREAN SECTION

Caesarean section, which consists of incision of the uterus and removal of the baby, may be *vaginal* or *abdominal*. The former will be discussed later.

Abdominal Caesarean section may be done in the upper or lower segment of the uterus. When done in the lower segment it may be performed transperitoneally or extraperitoneally. As we do not approve of the latter we shall only describe the transperitoneal method.

Comparison of the upper and lower segment Caesarean section. In older text-books the absolute and relative indications for section were given, and to a large extent we restrict nowadays the *classical* or *upper segment* operation to those cases with absolute indications and the lower segment operation to those where indications are relative.

The absolute indications for section are:

(1) Contracted pelvis with a true conjugate of 5·5 centimetres or under.

(2) Where absolute disproportion exists, *i.e.* where the obstetrician has no doubt that the relative size of the head to the pelvic cavity will not allow of delivery.

(3) In the cases of certain pelvic tumours such as carcinoma of the cervix and cervical fibroids.

(4) Bony tumour of the pelvis.

(5) Atresia of the cervix or vagina.

(6) Death of the mother (post-mortem Caesarean section).

Relative Indications.

(1) Where after a trial of labour (see p. 466) it is obvious that pelvic delivery is impossible.

(2) Placenta praevia (see p. 286).

(3) Prolapse of the cord (see p. 393).

(4) Fibroids and ovarian tumours (see p. 322).

(5) With a history of previous sections.

(6) Cardiac and renal disease.

(7) Tuberculosis.

(8) Certain toxaemias.

With regard to repeat sections, if we have done the operation ourselves, and the patient again enters hospital, we have no objection to giving her a trial of labour, but if we are unaware of the nature of the section the operation should be repeated. If there is a history of a morbid puerperium, section should be repeated, for the scar is likely to be weak.

The other indications have already been dealt with.

The lower segment operation has come to stay. Various methods of performing it have been suggested at various times by different authors and we shall describe our own technique. The *extra*-peritoneal route can never be a success, for there is a wide area of infection opened up and the operation is extremely difficult. We prefer the lower segment route when possible, and the following table will allow the student to understand the advantages and disadvantages of the two operations.

Before every section the presence of the foetal heart should be carefully ascertained.

In order to do a satisfactory lower segment operation there must be good labour, but it is more satisfactory to do the

	Lower Segment.	*Classical.*
Conditions present.	Child alive, except when true conjugate is below 5·5 centimetres.	Same.
	Must be in good labour.	Unnecessary to be in labour.
Advantages and disadvantages.	Must be in labour, therefore operate possibly at an inconvenient time.	May be done at a time convenient to the patient and doctor.
	Scar covered, therefore less likely to infect the peritoneum.	Scar exposed.
	May be done in a potentially infected case.	Any possible infection, a contraindication.
	Scar in passive portion of uterus.	Scar in active portion of uterus.
	Safer for pelvic delivery subsequently.	Not so safe.
	Operation longer and more difficult.	Shorter and easier.
	A trial of labour might save section.	Unnecessary operation may be done.
Morbidity.	Is greater, but difficult to compare with classical because many of the cases are infected before operation.	Small morbidity rate.
Mortality.	Should be practically nil.	Same.

classical operation before labour starts, for then there will be no bustle about getting theatre, etc. ready. There is no doubt whatever that a scar covered with bladder peritoneum and sutured low in the pelvis is less likely to lead to general peritonitis than one situated in the upper abdomen; also that a scar in the passive portion of the uterus will heal quickly and will be less likely to rupture than one in the upper contractile portion. It is safe to perform the lower segment operation in an infected case when the baby is alive, provided great care is taken not to touch the upper abdomen with the gloves which have been in the uterus. The greatest advantage in the lower segment is that with it in view a trial of labour may be given to cases which generally would have been subjected to section at sight, and that many examples of natural delivery may be

cited where a trial of labour was given to this type of case.

As stated in the table, the morbidity is greater after the lower segment operation, but the class of case in which it is done accounts for this.

If section of either variety is done in patients selected for the operation the mortality should be nil.

Time of election. The best time to perform Caesarean section is at term, or in the early stages of labour. The classical operation is done before labour starts, but the lower segment operation must be deferred until a well-formed lower segment is present.

Preparation of the patient. The method of preparing a patient for abdominal section is described in surgical and gynaecological text-books. We use 3 per cent. picric acid in 90 per cent. alcohol on the skin.

The room. The ideal is a properly equipped theatre; sometimes, however, it is necessary to perform the operation in the country, and a clean and well-lighted room is then chosen. Should the operation have to be undertaken at night, good artificial light is essential, for nothing is more likely to lead to disaster than poor light. Two lamps and plenty of candles will suffice, and it is well not to be sparing in the number of candles. Electric torches will be invaluable. Unless the artificial light is electric, avoid ether, for the vapour catches fire with extraordinary readiness. Even if the anaesthetist uses chloroform, the room must be well ventilated, for an artificial light near chloroform forms carbonyl chloride, which will act as a respiratory irritant. A deal kitchen-table covered with two or three blankets, a mackintosh, and a sheet, from below up, forms the operating-table. In preparing a room there is great danger in disturbing the dust. To avoid this wring out sheets in corrosive sublimate solution and spread them over dusty furniture and tops of presses. Wet sawdust sprinkled on the carpet will render sweeping safe. As a further precaution the broom used should be kept moist with corrosive sublimate solution, and all dusting should be done with a towel wrung out in an antiseptic solution.

Instruments.

3 scalpels.

12 artery forceps.

2 or 3 pairs of scissors, one of which should be long and strong.

2 pairs of bullet forceps.

Curved round-bodied needles graduated from cervix to perineum needles.

2 needle-holders.

In addition we use a Reverdin needle and Michel's clips for the skin, but these additions depend on the taste of the operator. If the lower segment is the choice, a Doyen's retractor is necessary. Silk thread No. 4 is used in the classical operation. Catgut No. 4 is used when the incision is in the lower segment. Silkworm gut should be prepared for inserting tension stitches in the abdomen.

All the above as well as abdominal wipes should be sterilised or brought ready sterilised.

Sterilisation of instruments at the house. Sometimes it is necessary to do this at the house, but it is better to bring them ready in sterilised towels. The basins in which the instruments and wipes are placed are too large to be boiled. We wash our hands and scrub the basins inside and out with Monkey-brand soap, or with ordinary soap and a boiled nail-brush. Flush this soap away by holding the basin under the tap. Finally, sink the basin in a bath of corrosive sublimate (1–1000). We look upon the cleansing of basins before all obstetric operations as an essential precaution. The burning of a little methylated spirit on the basin is a quick and probably a sure method of disinfection.

The instruments are boiled in a fish-kettle, in weak lysol or soda solution, to prevent rusting. They can well be kept in the fish-kettle, which forms a sterile dish for them. They are boiled for twenty minutes. The knife is blunted by prolonged boiling. Therefore wrap it up in wadding and boil for three minutes. Use rubber gloves, boiling them in water and then soaking them in a basin of methylated spirit.

During the operation, have the instruments in basins in plain boiled water.

Assistants. In the hospital, in addition to the theatre

sister and nurses, three assistants are necessary. If the operation is done in a private house there will probably be only one nurse, but there must be three assistants—one to give the anaesthetic, the second to assist the operator, and the third to look after the baby and to do artificial

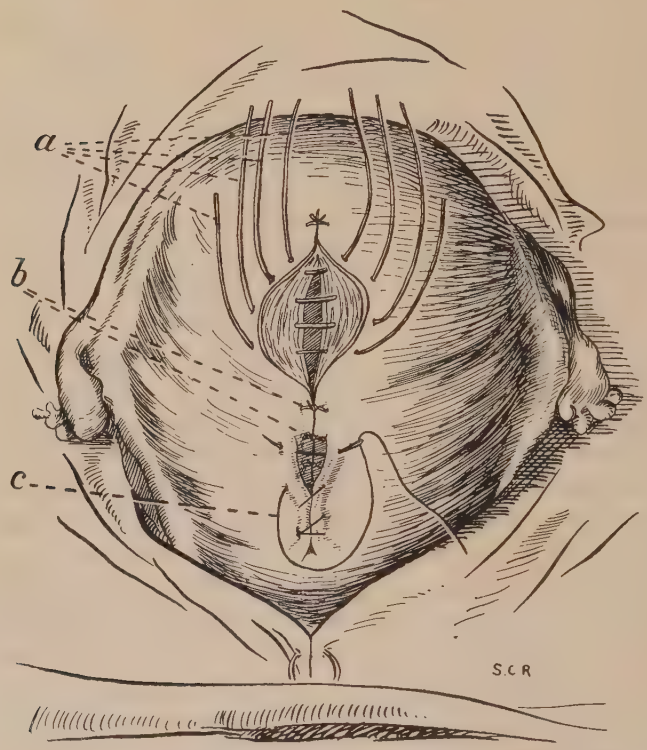


Fig. 263.—Classical Caesarean section.

a, silk stitches inserted, *b*, silk stitches tied; *c*, continuous peritonealising stitches of catgut.

respiration if necessary. *The last should be skilled in this proceeding.*

Cleansing the hands and forearms of the operator and two assistants. The hands and forearms are prepared as for any other abdominal operation. We use 1 in 2000 spirituous solution of biniodide of mercury. When possible we use sterilised gloves. Sterile masks and gloves should be worn.

The classical operation (see Fig. 263).

The anaesthetic. If there is time, atropine sulphate gr. $\frac{1}{100}$ is given half an hour before the operation commences. Ether or gas and ether is the choice unless there is any chest abnormality, when stovaine intrathecally may be given. If the latter is chosen, scopolamine gr. $\frac{1}{100}$ and morphine gr. $\frac{1}{4}$ are injected $1\frac{1}{2}$ hours and these two drugs in doses of gr. $\frac{1}{200}$ and gr. $\frac{1}{6}$ half an hour before operation. One cubic centimetre of stovaine 5 per cent. in glucose is then introduced into the spinal canal, and the operation may be started four or five minutes later. The table is placed so that the legs face the light. A catheter is passed before commencing. We stand on the left side of the patient; the second assistant on the opposite side, while the assistant who is ready to receive the baby stands near by in a convenient situation. All are gowned, masked and gloved.

An incision is then made in the middle line from the symphysis upwards to the umbilicus; there is no need to go higher than this; a fresh knife severs the underlying tissues. When the abdomen is opened the uterus is put straight and is pressed into the wound by the assistants. An incision is made in the anterior wall with the third knife for a short distance. A curved scissors is put into the opening and the incision is extended for five inches downwards. The membranes are ruptured, and if the placenta is not lying in front, a foot is caught and the child rapidly extracted. The second assistant clamps and cuts the cord, and the operator hands the baby to the third assistant, who performs artificial respiration if necessary. If the placenta is lying in front it must be removed out of the way if necessary and the child removed afterwards.

When the child is being extracted the uterus is drawn out of the abdomen. The skin edges above it are kept together with bullet forceps, and a towel wrung out in hot saline is placed around the uterus. The placenta is now removed manually, after which the uterus is inverted to make certain that all membrane is away; if the membrane is difficult to remove a gauze wipe will be found of great assistance. If the patient is not in labour the cervical canal must be opened up. This can be done with a dilator, which is pushed through into the vagina.

Sewing the uterus. We use interrupted through-and-through stitches of No. 4 silk. These go down to the decidua but not through it; they are placed about one-third of an inch apart. Over these stitches a continuous catgut suture is placed, bringing the peritoneal surface together. The hot towels are replaced at intervals. The abdominal wound is now closed.

Pituitary extract 1 c.c. is injected immediately the abdomen is opened, and ergotamine tartrate 1 c.c. after the birth of the child.

The question of sterilisation. We feel that it is justifiable to sterilise the patient after two Caesarean sections if she so desires. There is, however, no need for sterilisation for fear that a future labour may rupture the uterus. If the operation is properly performed this will not occur. Sterilisation is best done by (1) removing the fimbriated end of the tube, (2) doubling the tube on itself and tying it with silk.

The after treatment is the same as for any abdominal section. The patient is encouraged to move about freely. Castor oil 1 oz. or mist. sennae co. 2 ozs., or two pills such as $2\frac{1}{2}$ gr. each of pil. col. co. and pil. hydrarg. are given on the second morning. The baby is put to the breast as after ordinary delivery. She gets up on the eighth day and leaves hospital at the end of two weeks.

The lower segment operation (see Figs. 264, 265). The conditions and indications for this operation have already been considered.

It is the operation of choice when section is chosen for placenta praevia, for it is obvious that a uterus already possibly infected is safer when the incision is in the comparatively innocuous lower segment covered with bladder peritoneum.

The typical case is where the patient has been in labour for some time, who does not appear likely to deliver herself of a living child either naturally or with the help of forceps, and in whom the conditions necessary for pubiotomy are not present. It allows induction with subsequent trial of labour, with the definite knowledge that should the diagnosis prove to be incorrect and the disproportion be too great to

permit the head to mould and to pass through with the birth of a living child, section can be done with comparative safety.

In former days we used to practise the modified Pfannensteil incision, and, having incised the vesical peritoneum, sutured it to the upper flap of the parietal peritoneum, but we have discarded this method. It is a lengthy procedure and no practical advantage is gained.

The table is kept level during the entire operation. The abdomen is opened by a suprapubic mesial incision. A

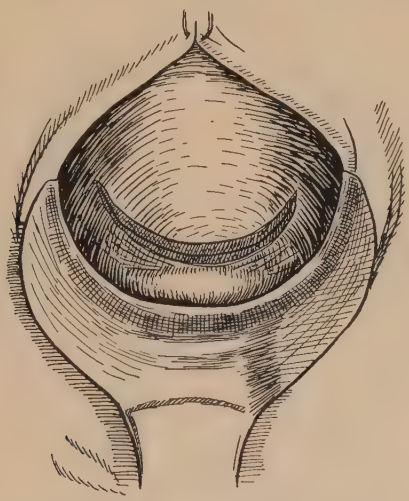


Fig. 264.—Lower segment Caesarean section.
Line of incision in uterine wall.

large wipe wrung out in saline is placed on each side to keep back the intestines. Pituitrin 1 c.c. is injected; this is a good practice, and less haemorrhage has resulted since the injection was given at this stage. The bladder peritoneum is cut across and the bladder is gently wiped down for a very short distance. The uterus is now incised. One of two types of incision is used, depending on the nature of the case. If the head is floating, the semi-elliptical incision, as suggested and practised by Kerr, Hendry, Holland, and others, is employed. This is a great advance on the straight transverse incision; while it ensures being in the lower segment it saves the necessity for much,

if any, pushing down of the bladder, with consequent haemorrhage from pre-vesical veins. If, however, the head is inclined to fix in the superior strait—that is, if the greatest diameter would not get through the brim but is partly fixed—a longitudinal incision is used, and makes for facility. It has the disadvantage that the bladder must be pushed down, but it has a very real advantage in that the head can

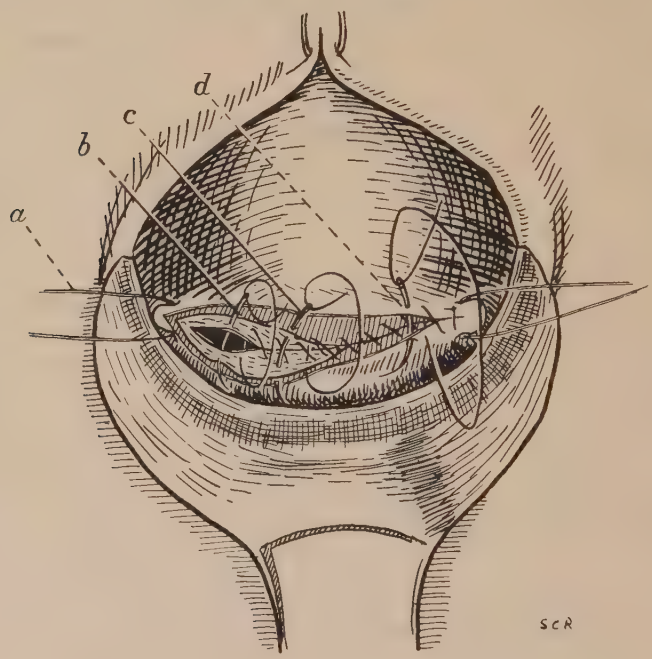


Fig. 265.—Lower segment Caesarean section.
a, traction stitches; *b*, first layer of stitches in uterus; *c*, second layer of stitches in uterus; *d*, stitches in bladder peritoneum.

be handled more easily. With this incision the delivery is effected with forceps; one blade has been tried, but the whole instrument is preferred. When the head is under the hand —that is, floating—it is easily removed, either by pressure from the fundus alone or combined with pressure from under the uterus, or by placing a finger in the mouth.

Some authorities have suggested the possibility of dropping the cord back into the uterus after separation, and expressing it into the vagina; this does not appear to be

reasonable. The uterus is open, the infected cord has been out of the uterus; why not take the obvious and quick method of expressing into the incision, and making sure of its speedy departure? In addition, the suturing will be more difficult, and the possibility of an adherent placenta with necessary manual removal at the completion of the operation will increase its dangers.

If the presentation is transverse, version must be done. If a breech presents it is delivered by traction on the leg.

In suturing the uterus a word of warning must be uttered. The inferior edge of the incision is liable to retract, and it is quite possible, if this edge is not clearly defined, to suture the superior edge to the posterior uterine wall; this may sound impossible to some, but it is an eventuality which is possible if care be not taken.

The suture material has been the bane of many obstetricians. Tanned catgut is used all through.

Two guy stitches are placed in each angle, passing through all coats. A continuous suture of No. 4 catgut then embraces the endometrium and the deep part of the muscle layer; a continuous second suture of the same material encloses the other parts of the muscle. Finally, a third continuous suture brings the peritoneum over the scar. Continuous sutures are quicker and just as effective as interrupted stitches, and they do not cause gangrene of the tissues. This has been proved to our complete satisfaction in the operation of trachelorrhaphy, where the method of continuous suture is always used. The strength of the scar following the adoption of this method has yet to be proved.

The question of drainage is a very important matter for consideration. The best dictum is—when in doubt, drain; a drain can do no harm in doubtful cases, but its absence may be harmful. Drainage in suspicious cases is a most important asset. The low Caesarean operation can be performed with safety where craniotomy on the living child might be an alternative; drainage puts another weapon into our hands.

VAGINAL CAESAREAN SECTION

The indications for this operation are very small and consist in any reason for emptying the uterus rapidly.

It is a difficult procedure and must therefore be reserved for the trained obstetrician. It is one of the suitable methods of emptying the uterus in early months. It may be done up to term, but the more advanced the pregnancy gets the more difficult the operation becomes.

It is performed as follows :—a posterior speculum is first passed and a bullet forceps is placed on the anterior lip of the cervix; a transverse incision is then made across the vaginal mucous membrane at the junction of the bladder with the cervix. The bladder is then separated from the cervix as far as the internal os. It is kept up by means of an anterior retractor. A scissors is then placed in the cervical canal and the anterior lip incised as far as the intern os in the middle line. Until the eighth month this is sufficient. Later the vaginal mucous membrane must be incised posteriorly and pushed backwards so that the posterior lip may be incised in a similar manner. The baby is then extracted either with forceps or by extraction after version. When indicated the head is perforated if the child is dead. The placenta is removed manually. The incisions in the uterus are sewn with continuous catgut and the incisions in the mucous membrane are then closed.

PUBIOTOMY AND SYMPHYSIOTOMY (see Fig. 266)

At the Rotunda we practise the former operation, but not the latter, *i.e.* we divide the pelvic bone, not the symphysis pubis. The conditions and indications for both are the same. Some obstetricians consider that there is no place for either of these operations, but we shall demonstrate that there are still small but important indications.

Indications.

1. Contraction at the inlet.
2. Contraction at the outlet.
3. Malpositions.
4. Definite disproportion with no evident contraction of the pelvis.

The diagnosis of all of these has been considered already.

Pubiotomy must not be performed except under the following conditions :

1. Child alive.
2. Not too great disproportion.
3. Cervix full or nearly so.
4. Vaginal canal dilated.

The child must be alive; otherwise some destructive operation should be done. The true conjugate should be at least 8 centimetres, and the disproportion should convey to the mind of the doctor that the external space will permit of pelvic delivery. The cervix should be fully or nearly fully

Fig. 266.—Diagrams of the lines of separation of the bones in symphysiotomy and pubiotomy.

dilated: this is a most necessary condition. Pubiotomy done before the cervix is fully open means a severe tear of the vagina, for we advise delivery immediately after the operation. The vagina should be dilated by a gradual ironing out in the manner already described. Some authorities have suggested that the presentation should be cephalic; we regard this as being nearly but not absolutely essential, as it may be necessary to give a trial of labour in breech presentation, and an effort must be made to compute the relative size of the head and the pelvis. If pubiotomy is to be done, the saw should be passed before the breech is delivered, so that if there is difficulty with the head the bone may quickly be divided. This certainly will be

extremely rare, so that generally speaking the presentation should be cephalic.

Infection is not a bar to pubiotomy, in fact this and the lower segment Caesarean are the only operations possible in some cases of "failed forceps" with the baby alive; we regard it as no more dangerous in these cases than craniotomy.

The typical case for pubiotomy is the patient who has been given a trial of labour and who cannot bring the head

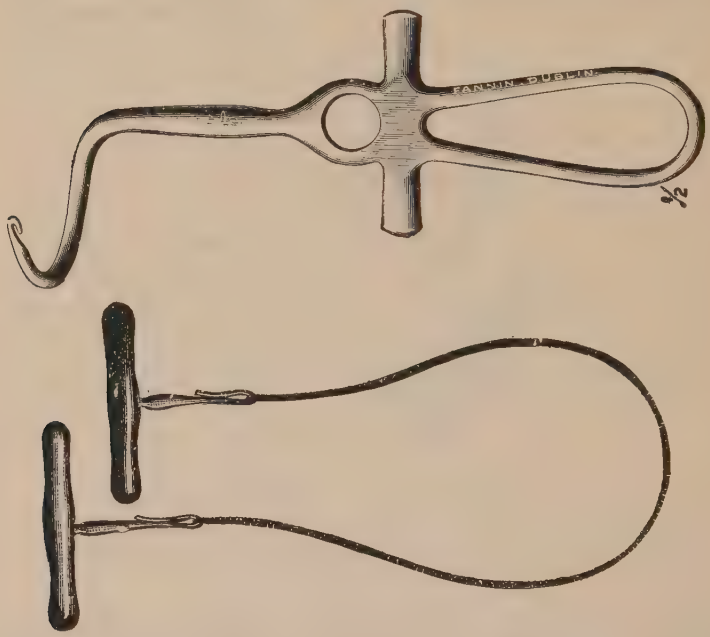


Fig. 267.—Döderlein's pubiotomy needle (upper figure). Gigli's saw (lower figure).

altogether through the superior strait. There may or may not be contraction of the outlet with or without general contraction. A finger in the rectum demonstrates the absence of advance. It is decided to try tentative forceps. These are applied. The amount of pull is largely a matter of experience, but it is absolutely obvious that a bony hold-up can be diagnosed with ease; in other words, the impression is given that a pull will break the foetal skull against the pelvis. Walcher's position, which adds about 1 centimetre to the true conjugate, must always be used.

Preparations for pubiotomy. All instruments are got ready. The patient is shaved and the vulva is painted with picric acid 3 per cent. in 90 per cent. alcohol. The vagina is disinfected. The patient is placed in the cross-bed position with the legs held by two assistants.

Instruments required.

1. A catheter.
2. A scalpel.
3. About a dozen Kocher's haemostatic forceps.
4. Needle-holders, curved needles.
5. Scissors.
6. Two Gigli's saws.
7. A Döderlein's blunt pubiotomy needle (see Fig. 267) for the open operation, or a Bumm's needle (see Fig. 268) for the subcutaneous method.

Fig. 268.—Bumm's subcutaneous pubiotomy needle.

Catgut, silkworm gut and such operative requisites as sterile gauze wipes are required.

Time of election. When the os is fully dilated. It can be done before this and labour allowed to continue, but we do not recommend it.

The operation. With Döderlein's needle. Before commencing the operation the anatomy of the parts must be considered. The main points of importance are the pubic spine, the sub-pubic ligament, and the dorsal vein of the clitoris, which may get torn. Bleeding may occur also from the inferior vesical plexus, the bulb of the vestibule and the vagina itself. The patient's legs hang down. The assistants sit close against the hips.

A small incision is made down to the pubic bone just outside the pubic spine. The Döderlein's needle is introduced (see Fig. 269), hugging the bone closely, even insinuating it

under the periosteum. A finger in the vagina follows its course.

The point of the needle emerges beneath the arch about $\frac{1}{2}$ to $\frac{3}{4}$ inch from the centre, bulging the soft parts in front of it. Pull these well inwards over the point and expose it with a nick of the knife. The object of pulling the parts inwards is to ensure that the point of the needle emerges through the skin outside the labium, thereby preventing haemorrhage from the cavernous tissues.

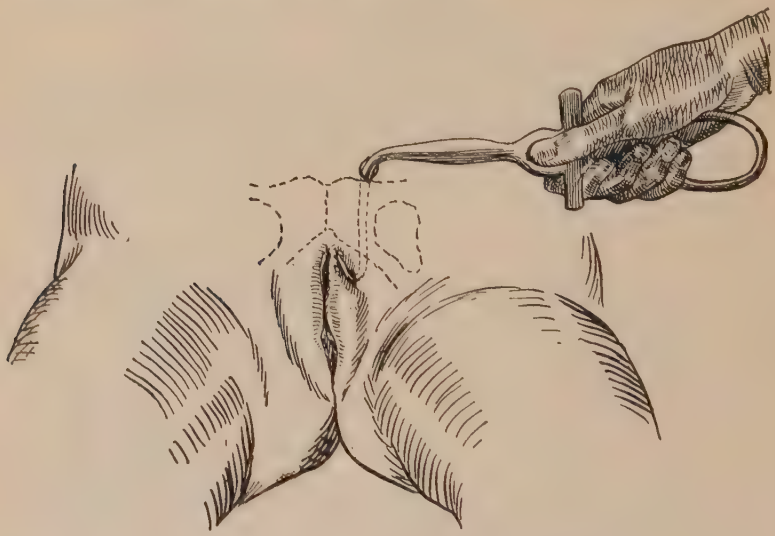


Fig. 269.—Pubiotomy. Passing the Döderlein needle.

Attach the Gigli's wire saw to the special hook on the end of Döderlein's needle. Withdraw the needle, which pulls one end of the saw out of the upper wound. The assistants press the thighs together so that the bones may not separate too quickly and tear the vagina.

Attach the two handles to the ends of the saw and saw up and down, keeping the saw as straight as possible, for there is then less laceration of soft parts and less likelihood of breaking the saw. Proceed cautiously when the bone is nearly severed, and be ready to detect complete severance by the change of sensation, should the assistant fail to detect it at once. This can be ascertained before the saw is with-

drawn by pressing the skin between the separated bones with the top of the finger. The bones, apparently, do not spring apart unless the head is being forced down by the contracting uterus.

When the bone is completely severed, forceps are applied to the head, the patient is put in Walcher's position and delivery accomplished, the assistants retaining pressure on the thighs to some extent. A deep episiotomy is of assistance in preventing high vaginal tears. Immediately the baby is delivered, gauze wipes are placed at each incision to control haemorrhage. The wounds are sewn up with silk-worm gut if necessary.

Possible complications. Laceration of the soft parts, haemorrhage, haematoma, non-union of the bones, bladder injury, necrosis of the bone, limping and impaired walking.

Haemorrhage is easily controlled by pressure above and below. If lacerations occur, they are treated by suturing or by a gauze plug. We have not experienced any of the other complications suggested, and they should not arise. A catheter should always be passed before and after to exclude bladder trauma.

After-treatment. There is no special after-treatment, except that we find that the application of a navvy's belt is of great assistance and support. The patient is encouraged to move about freely in twenty-four hours; she sits out of bed on the twelfth day and leaves the hospital on the sixteenth or seventeenth day. There is no difficulty in walking.

Prognosis. Excellent.

Subcutaneous Pubiotomy. This is done with Bumm's needle. The preparations are similar to those already mentioned. The needle is passed from below upwards without any preliminary incision, through the soft parts and behind the pubes, following the course described in Döderlein's operation. The needle is kept pressed against the bone by a finger in the vagina. A Gigli saw is attached to a hook in the eye of the needle and pulled from above downwards behind the pubes, which is now severed as in the open operation. The soft parts move with the saw and are not lacerated.

The advantages claimed for this operation are that the

needle is finer and does less damage; it is probably a little more simple than the open method. We favour the modified Döderlein's technique.

Symphysiotomy. Nowadays we do not perform this, but as it is regarded as a classical operation, we describe it below. The conditions and indications are the same as for pubiotomy. The only instrument required in addition is a director.

The operation. Make an incision through the central skin of about an inch, starting half an inch above and continuing it down to the symphysis. Deepen the incision over the pubes until the knife grates on the bone. Insert a finger into the wound and pass it over and down behind the pubes. Separate the bladder well by sweeping the finger from side to side between the bladder and the pubes. Pass the finger further down and hook it under the pubic arch. The bone is now cleared.

The two helpers keep the hips pressed together, for when the symphysis is cut through the bones may gape suddenly, from the descent of the head, resulting in injury to the bladder and severe haemorrhage from torn soft parts.

Put one finger of the left hand again into the wound and keep back the bladder. Cut through the cartilage of the joint with the knife, slowly from above downwards and from behind forward, without severing the stout sub-pubic ligament. If preserved, this ligament, though stretched, forms a natural splint and facilitates successful recovery. The knife readily passes through the cartilage. Sometimes it is necessary to cut the sub-pubic ligament to allow sufficient room for the head to pass. Stop any haemorrhage by tying the bleeding vessel with silk, or by the pressure of iodoform gauze.

The child is delivered by forceps in Walcher's position. Close the wound with interrupted silkworm gut sutures. Neither the bone nor the deep parts of the wound need be brought together by sutures. Dress with aseptic pads or gauze and wool and keep on the dressing by a T bandage. Apply the binder and pull the separated bones together by a stout canvas belt with straps and buckles. These need not be excessively tight. Care should be taken not to nip

the bladder between the bones. An ordinary navvy's belt from a harness-maker does very well. A binder is not strong enough for this purpose but will do temporarily.

After-treatment. The patient can be gently turned on her back in twelve hours, and turns herself after twenty-four hours.

Pass a catheter every eight hours. Open the bowels, give water and food, and put the baby to the breast, as after Caesarean section. Dressings and stitches are left until the sixth day, provided the wound is clean. Watch carefully for cystitis; this is a possible sequel if the bladder has been injured. Sepsis and injury to the urethra and vagina are also complications.

It was formerly thought that convalescence from symphysiotomy was bound to be tedious and painful, but when aseptically performed this is not the case. Our last patient walked on the sixteenth day. In changing dressings, pads, sheets, the patient can be lifted bodily by the belt or underlying binder without causing any discomfort, and she is always lifted in this manner when the draw-sheet is renewed. When the binder is to be changed it is slipped into the hollow of the back, the patient is raised by the belt, and a new binder laid under her. The belt is then slipped up and taken out, the patient raised by the binder, and the belt replaced outside the binder as before.

Comparison of pubiotomy and symphysiotomy. The indications for these two operations are the same, the added half-inch (1·25 cm.) that they give to the conjugate of the brim is the same, and therefore it becomes essential to decide which of the two is the better operation. Symphysiotomy is the older operation, nevertheless we think pubiotomy will be the operation of choice, for the following reasons :—

1. It is easier to perform.
2. The bladder and urethra are less likely to be injured.
3. The bone unites as in a simple fracture.
4. There is sometimes a lasting increase in the size of the pelvic brim as demonstrated in two of our cases: we only hope for fibrous union.

Disadvantage of pubiotomy. The special instruments

required may not be obtainable. Those for symphysiotomy are always available.

DESTRUCTIVE OPERATIONS

Destructive operations are seldom done at the Rotunda, and are only performed with the following conditions present:

1. The child must be dead.
2. The true conjugate must be over 5·5 centimetres.

Craniotomy of the live child is unjustifiable in these days, for other methods of delivery, such as the lower segment Caesarean section, are equally safe for the mother. The only possible exception to this rule is hydrocephalus, and here we have to deal with a potential imbecile. The question of the size of the pelvis has already been dealt with.

The following terms will be used in this chapter, and the definitions are modified from Dorland's dictionary:

1. Craniotomy. The cutting in pieces of the foetal head to facilitate delivery. It is generally understood to mean a destructive operation on the head.
2. Cephalotripsy. The crushing of the foetal head.
3. Cephalotribe. An instrument for crushing the foetal head. It is used for breaking up the base of the skull.
4. Cranioclast. An instrument for crushing the foetal head. It is used for crushing the vault of the skull.
5. Perforation. Making an opening in the foetal skull.
6. Cleidotomy. Cutting the clavicles.
7. Spondylectomy or Spondylotomy. Division of the clavicles.
8. Decapitation. Removal of the foetal head.

Craniotomy.

Reason for its frequency in the past. Craniotomy is an operation that is performed less frequently now than in the past. We now endeavour to diagnose contracted pelvis or disproportion in the ante-natal clinic or even later in the labour ward.

In the past the patient was not seen until labour was well advanced. Forceps were often applied before the indications

for them were fulfilled : that is, the fixing of the head by its largest diameter in the brim and the full dilatation of the os. The application of forceps to the head above the brim was known as the operation of high forceps. A doctor watched his patient in labour for some twenty-four hours and then decided to deliver her, although no proper indication for forceps was present. The temperature and pulse of the mother were not noted at all. He then put on the " high " forceps, and sometimes succeeded in delivering the child. When there was some degree of contracted pelvis, as often as not he failed, and he then proceeded to perforation. Had he waited until the head moulded, this disastrous result would seldom have been necessary. We know, for example, of a doctor who, having tried to pull a child through with high forceps, rode home to fetch his perforator. On his return he found the child born by the natural efforts of the mother.

We never recommend high forceps. A thorough examination of the relation of the foetal head to the pelvis combined with pelvimetry has reduced the number of craniotomies to a minimum.

Indications for craniotomy. When Caesarean section and pubiotomy are indicated and the child is dead.

Instruments required for craniotomy.

1. A perforator. We use Simpson's (see Fig. 270).

2. A combined cephalotribe and cranioclast. We favour Winter's (see Fig. 271), but the two separate instruments are described.

3. A large Bozeman's return-flow catheter.

4, 5. Possibly bullet forceps and Schultze spoon forceps. These may be used as alternatives in the actual delivery of the head.

Preparation. The patient is anaesthetised and put in the cross-bed position. It is essential in this operation to be absolutely surgically clean. The patient is exhausted, and it has been definitely proved by bacteriologists that exhaustion greatly lowers a patient's resistance to infection. The broken bones have sharp points and tear the soft parts. The perforator may slip and injure the soft parts. Often the os is not fully opened, and so the cervix is lacerated.

It is a rough and somewhat brutal operation, in which parts are most likely to get lacerated and offer channels for infection in a woman now less able to resist it.

The external genitals and vagina are prepared as for other operations and the bladder is emptied.

Fig. 270.—Simpson's perforator.

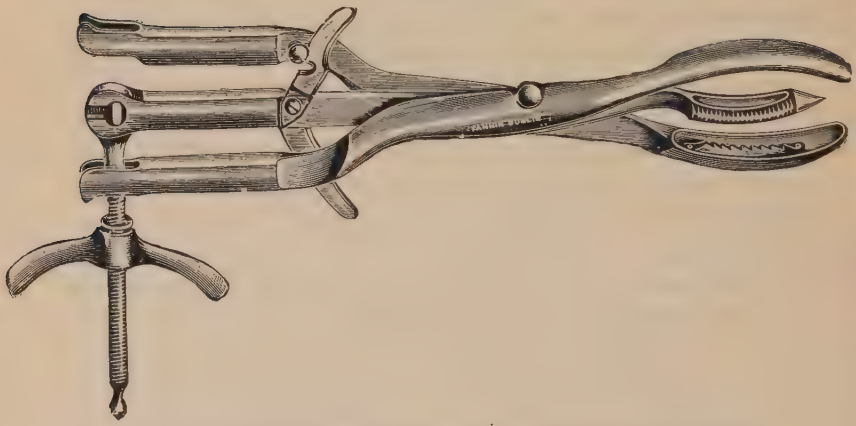


Fig. 271.—Winter's combined perforator, cephalotribe, and cranioclast.

Operation. This consists of:

(*a*) Perforation.

(*b*) Washing out the brain matter.

(*c*) Crushing the vault of the skull with the cranioclast.

(*d*) Crushing the base of the skull if necessary with the cephalotribe.

(*e*) Extraction, or else extraction may be done after (*c*) if the head is considered small enough.

The perforator. To perforate successfully, once more remember the golden rule of putting the whole or half hand into the vagina. Make sure that the head is presenting by feeling a suture or fontanelle. Get the nurse or an assistant to press the head down towards the pelvic cavity (see Fig. 272), thus causing artificial fixation of the head

whilst perforating, for if the head shifts after perforation it may not be easy to find the hole again. Pass the perforator up to its shoulder, through a fontanelle, suture, or bone, depending on which is easiest to reach. Bore a little with the

Fig. 272.—Perforation. Showing how the hands of the assistant push down the head. The perforator has been opened once and is in position for the second opening.

point to get it through the bone, surrounding the instrument with the fingers to prevent slipping. Having pierced the skull and buried the perforator up to the shoulder, open the instrument. Close it again, turn it round half of a circle, and open it again. The fingers, as we have said, show whether a sufficient hole has been made. One more step we

advise, namely, to push the perforator up to the medulla of the child. We think that we shall never have to perforate a living child, but it is possible one might decide a baby was dead when it was really alive. When the child is born and the medulla is not destroyed, the child cries, and this must be a horrible experience, which can be prevented by pushing

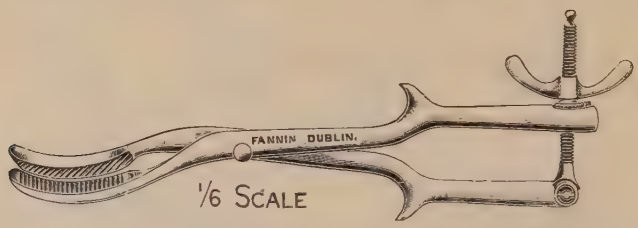


Fig. 273.—Cranioclast.

the perforator on to the medulla and turning the point of the instrument round in the soft medullary nerve matter.

Washing out the brain. The next step is to withdraw the perforator and douche out the brain matter. Pass a large Bozeman's catheter through the hole in the skull

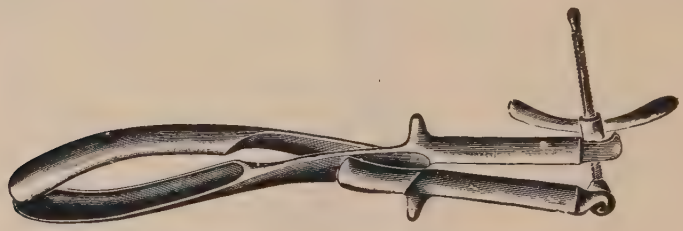


Fig. 274.—Cephalotribe.

and break up and douche out the brain. Remove any loose bone with forceps.

Extraction with the cranioclast. It is not difficult to fit the cranioclast. Take the inner blade, and, guiding it with fingers in the vagina, push it through the hole in the skull as far as it will go. Take the other blade and push it up outside the skull, where there is room. If the blades do not lock, tell the nurse to refrain from pressing the head down. Keeping the outer blade in its place, turn the inner blade so that they will lock. The head will probably spin round with the inner blade. Screw the blades together and

pull. Feel with the fingers for any sharp spicules of bone and prevent them lacerating the vagina. If the head will not come through, spin it round in another position and pull

Fig. 275.—Cephalotripsy.

again, but do not twist and pull at the same time. Pull it in the position in which it descends most readily. Remember, too, that further advance after some descent may be prevented by the shoulders. If this is so, pass up stout

scissors, and, directing their action with the fingers, cut through the clavicles.

When the pelvis is very small the head cannot be extracted without breaking it up more completely.

Extraction with the cephalotribe. The cephalotribe (see Fig. 274) is an instrument which is very seldom necessary,

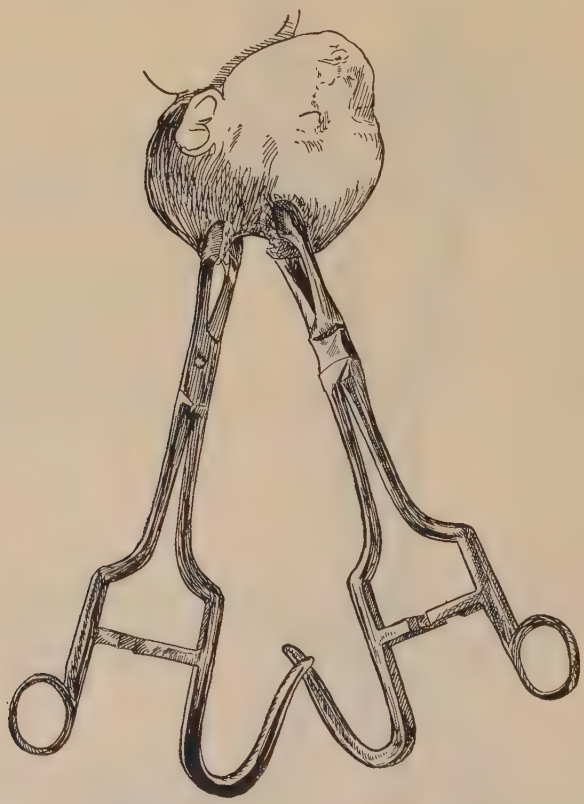


Fig. 276.—Schultze spoon forceps applied to edges of perforation wound.

but in some cases the base of the skull must be caught between the blades and extracted. The blades are applied as in forceps and the tops must reach up to the child's neck: also the widest diameter of the head must be grasped or they will slip. Screw up tightly until the base of the skull is fractured and deliver the child in the axis of the pelvic cavity.

Extraction with Winter's combined cranioclast and cephalotribe (see Fig. 275). This is the most effectual instrument. First put on the cranioclast, and usually that will suffice. If it does not, fit the cephalotribe blade and crush the base of the skull. This is easier than with the cephalotribe only, for the cranioclast keeps the head steady and prevents it from slipping whilst the cephalotribe blade is fitted. Study the instrument before using it, so as not to get confused by the fitting of the three blades.

The ideal position for the blades of the combined instrument are : the centre blade is inside the opening in the skull, the other two are over the face and occiput. They must be well over both, and this is possible in nearly all cases ; if the face and occiput are not sufficiently covered, the amount of crushing may not be enough to deliver the child. Sometimes after perforation and removal of brain matter the edges of the bone can be caught in two Schultze's spoon forceps (see Fig. 276) and easily delivered. This is a specially suitable method when the cervix is not fully dilated, for the forceps take up less space than the cranioclast. The Schultze forceps are the first choice.

Perforation of the after-coming head. This is best done through the occiput or through the posterior fontanelle. By these routes the brain can best be got at and removed. The roof of the mouth is an alternative way, but it is not so satisfactory.

Perforating the separated head. Sometimes in extraction of difficult breech and in decapitation the separated head is left in the uterus. As a rule it is easy to extract by getting an assistant to press it into the pelvic brim, putting forceps on to the head and extracting. If this fails, the head is pressed downwards by an assistant and perforated. The cephalotribe and cranioclast are used if it is necessary to diminish the head further.

Douching the uterus. After craniotomy or other destructive operation the uterus should be douched.

Evisceration.

Sometimes delivery of a dead child is delayed by an abnormally large chest or abdomen. If the chest is the

cause of delay, and cutting through the clavicles with stout scissors fails to effect delivery, get the nurse to pull or push the child down as far as possible, so as to get the chest

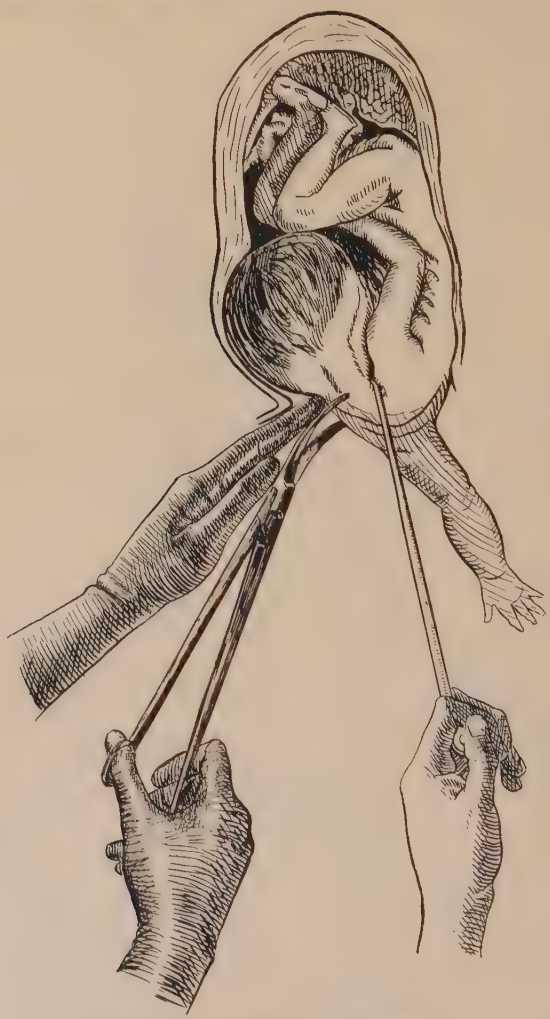


Fig. 277.—Operation of Decapitation.

within reach, then, directing the scissors with a hand in the vagina, open the chest. Remove the viscera manually. If the child's swollen abdomen is the cause of delay, clear out the abdominal viscera in a similar way. Douche the uterus thoroughly after evisceration. Have the patient under

chloroform, both to save her pain and the repulsive sight of a mangled child.

Decapitation. The conditions and indications are described on p. 381.

This is a difficult operation. Under deep anaesthesia an arm is grasped if not already down. An assistant pulls on this. The operator passes a Braun's blunt hook over the child's neck, guiding it with the fingers in the vagina. The hook dislocates the neck. If rupture of the uterus is imminent the hook should not be manipulated too forcibly, but simply used to draw the neck gently downwards. A long blunt pair of scissors is then passed up to the neck, which is cut through (see Fig. 277). The body is then removed by traction on the arm. If it is very large, cleidotomy may be done. The head may be delivered by pressure on the fundus, or forceps may be applied after fundal pressure. If it is too large, then it must be perforated and if necessary crushed. This is the method which we recommend as being safest. Sharp hooks are definitely contraindicated because of the danger to the soft parts. Great care must be taken by the nurse that the mother should not see the mangled child.

Spondylotomy or Spondylectomy. Division of the vertebral column has sometimes to be done instead of decapitation, when the neck cannot be reached in neglected shoulder presentation. It is a difficult procedure and should be done with blunt scissors after evisceration.

Cleidotomy, or division of the clavicles. This is done in the case of large shoulders. One or both clavicles are divided at the junction of the middle and inner thirds. We do not regard this operation as safe on the living child and we only advise it when the child is dead.

Amputation of limbs. Sometimes this may be necessary to facilitate delivery of a dead child. It is done with scissors.

Perineorrhaphy.

Incomplete (see p. 170).

Complete (see Fig. 278). When the tear extends through the mucous membrane of the rectum sew it up carefully,

and at once, to avoid incontinence of faeces. Give the patient an anaesthetic if she is not already under its influence. Put her in the cross-bed position with her buttocks well over the edge of the bed. Douche the parts clear of blood.

Fig. 278.—Suturing a complete tear of the perineum.

Uniting the rectal mucous membrane. This is done by interrupted catgut sutures, which are passed and tied so that the knots are left in the lumen of the bowel.

Pass the first at the upper angle of the tear in the mucous membrane. Take a fine fully curved needle, threaded with catgut. Pass it first from the rectal lumen through the edge of the mucous membrane at the upper angle of the tear, then through the opposing edge from without into the lumen of the bowel. The suture thus starts from, and ends

within, the lumen of the bowel. Consequently when the knot is tied it is in the bowel. Tie this suture and then continue with the next, or put in as many as are necessary to restore the mucous membrane tube one after the other, and then tie the highest, then the next, and so on. The catgut sutures are absorbed within the week.

The sphincter ani. The ends of the sphincter are now brought in front of the rectum by two silkworm gut sutures, the knots to be fastened on the perineum, anterior to the anus. The perineum is united with silkworm gut as in simple perineal tear.

After treatment. The patient is kept on albumin water for five days with an occasional cup of weak tea. She is then given castor oil 1 oz. and is told to inform the nurse when the bowels are about to move. Warm olive oil, four to five ounces, is then injected. The silkworm-gut stitches are removed on the eighth day. An alternative treatment is to keep the bowels moving from the beginning.

Failed forceps.

We feel it is advisable to write a short note on this subject at the conclusion of a chapter on obstetrical operations. It arises from incorrect or ill-advised attempts at delivery. Either conditions are not fulfilled or the case is unsuitable for forceps application, or both. There should be no failed forceps if the student would learn when the first stage of labour began and ended: if the physician would study the case: if he would not apply forceps before the cervix was fully open; if he would learn to recognise when the cervix is fully open. He should try to diagnose malpresentations. A thorough study of cases of disproportion would prevent many cases of failed forceps.

When the patient is seen she is either badly torn or bruised, or else the uterus is ruptured. The temperature and pulse-rates are high, the patient is infected.

We have seen cases which were spontaneously delivered two and a half days after failed forceps.

We have delivered by pubiotomy a woman whose vagina and cervix had been torn after several attempts at forceps. We have had to do craniotomy. We have had to treat

ruptured uterus. It is impossible to describe in detail all cases of this condition. We can only advise the attendant to pause before attempting forceps. If they are wrongly applied, the case must be treated on its merits, but in these days craniotomy on the living child is never necessary, and most examples of failed forceps will be delivered (1) spontaneously, (2) by forceps later, (3) by pubiotomy and forceps delivery, (4) by the lower segment Caesarean operation, (5) by craniotomy if the child is dead.

The difficulty in forceps is not the actual application or delivery, but the appreciation of the correct time for their application. This can only be learnt by observing and studying the course of normal labour in a maternity hospital.

PART VII

THE INFANT

CHAPTER XXIV

INFANTS

ASPHYXIA IN THE NEW-BORN

THERE are two forms of asphyxia in new-born children. They are distinguished by the colour. In one the skin is congested and purple, in the other, white.

Causes. Prolonged labour, especially if the membranes have ruptured for some time before birth. Difficult instrumental delivery. Intracranial haemorrhage. Prolapse of the cord. Ante-partum haemorrhage. Toxaemia of pregnancy.

Blue asphyxia. In this form the face is purple, as if suffocated, and the body is firm, and even rigid. The cord pulsates strongly. The reflexes are present. There are, of course, intermediate forms between this and "white" asphyxia, in which the child's face is neither purple nor white, and in which the pulsations of the cord are feeble.

Treatment. Do not encourage the baby to breathe before clearing its throat of mucus. The first breath will be inspiratory, and if it sucks mucus into its lungs it will pass into the more severe condition of asphyxia pallida. Neither should the cord be cut when it is beating strongly, for the child is getting its oxygen through the placenta.

First suck the mucus out of the child's throat with a catheter. We use the catheter illustrated on p. 79. Pass it over the back of the tongue and suck. Withdraw the catheter and blow out the mucus on to a piece of linen. Again insert the catheter, suck, withdraw, and blow the mucus out. Continue to do this until no more mucus can be removed. If a catheter is not obtainable, hold the child

up by its ankles and hook the mucus out of the throat with strips of linen wrapped round the little finger.

Having cleared the throat, make the child breathe. Its reflexes are present, and smacking it, or throwing a little cold water over it, will make it cry. Tie the cord, when the pulsations have ceased, and give the baby to the nurse.

In the intermediate cases, quickly clear the throat, cut and tie the cord, and treat as asphyxia pallida.

White asphyxia. In this asphyxia the child when born is of a deathly pallor, the limbs and body are flaccid and flabby, no reflexes are present, and either a very feeble, slow pulsation, or no pulsation of the cord exists.

Treatment. Take off the gloves. Tie one ligature only round the cord for speed. Cut the cord. Hold the child upside down by the ankles and suck or wipe the mucus out of the throat. Put it in a hot bath, as hot as can be comfortably borne by the hand. Hold its head out of the bath with one hand, and rub the hot water over it with the other. Push the fingers of the other hand up under the ribs until they touch the heart. If the heart has stopped beating the child is dead. But be sure it has completely stopped before abandoning treatment. The heart is often very slow. If it has not ceased, again suck any mucus out of the throat with the catheter. Sit down and dry the child quickly on a warmed towel. Use the mouth-to-mouth method very gently or try the "rolling" manœuvre. If the child does not appear to be reviving, do Schultze's artificial respiration four or six times. Again put the child in the hot bath, suck any mucus out of the throat, and feel for the heart. If there are any signs that it is coming round rub a little whisky on its gums and rub some whisky on its body. Again dry the child on a warm cloth, and repeat Schultze's artificial respiration. If the skin gets pink, try the effect of a little cold water thrown over it or plunge it into a cold bath for a few seconds. If it gasps, continue the artificial respiration, hot bath, and a sprinkling of cold water, until it cries. If it does not gasp, continue the hot bath, drying, and artificial respiration, as long as the heart beats or until the child cries. Watch it carefully by the fire after it has cried, for fear it should relapse.

Good results have been reported from direct massage of the heart in desperate cases of white asphyxia. A small incision is made into the abdomen just below the diaphragm, through this the gloved finger is passed up to the diaphragm. The thumb placed above the nipple supplies the counter-force for rhythmical massage of the heart. We have never practised this with success.

The Sylvester method, as applied to a person who has been nearly drowned, is effective, provided the infant's limbs are held so as to fix the diaphragm. It is done on the lap after removal from the bath.

Other methods for performing artificial respiration are—

(1) Mouth-to-mouth inflation of the lungs with air. The operator places a piece of gauze over the mouth and breathes into the chest four or five times. Each breath is followed by gentle pressure on the chest to produce an expiration. This must be done very gently and is very effective. It is the ideal method in most cases.

(2) Another excellent method is as follows. The physician places the baby on the lap and rolls it gently away from him, causing an inspiratory movement: he then brings it back towards him, causing the expiratory movement. This is done four or five times, after which the baby is placed in the bath again, rubbed with brandy, dried, and the whole process repeated.

We have been criticised for teaching the Schultze method of artificial respiration. We have saved lives with its help that we would not have saved otherwise: when done properly it is an excellent method.

One word of warning must be uttered. If the baby is suffering from the effects of morphine, energetic measures should not be adopted. The baby should be held in front of a fire, and the "rolling" or the mouth-to-mouth method done.

Lobeline injected intramuscularly or into the umbilical vein is occasionally useful. The dose is $\frac{1}{20}$ to $\frac{1}{40}$ of a grain.

How to do Schultze's artificial respiration (see Figs. 279, 280). The figures explain the manner of holding the child. The index fingers and thumbs encircle the axillae. The little fingers press against the occiput and steady the head, which also rests between the ulnar surfaces of the

hands. The middle and third fingers pass down the child's back. Stand with legs apart, and the child's body hanging between. This is the inspiratory position. Swing a little gently to and fro for a second or two to see that the grasp is firm, and that the child will not slip. Then swing it boldly forwards away, so that it sweeps upwards, until it is about the level of the head. Then, continuing the movement, draw in the extended arms, and the child's lower limbs fall over on to its chest with its head turned downwards.

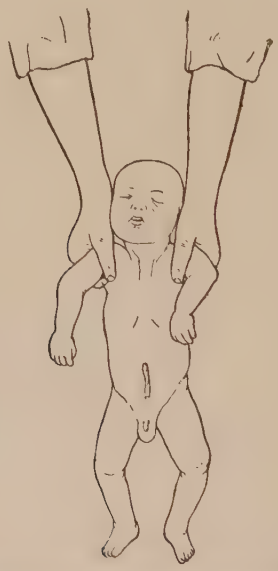


Fig. 279.—Schultze's artificial respiration Inspiratory position.

This is the expiratory position. The lower limbs falling over flex the child's abdomen, which in turn presses the abdominal viscera up against the diaphragm and makes it ascend into the chest. This ascension of the diaphragm into the chest is the action of expiration; it squeezes the air and mucus out of the chest. At the same time squeeze the ribs, doing this without in any way altering the position of the hands and fingers. Do not keep the child long in this position, for fear it should attempt to inspire. The necessary pause to prevent hurrying should be made in the inspiratory position; fling it outwards and a little upwards

by extending the arms. We do not mean to convey violence by the word "fling," but the secret of the correct Schultze's method is to make the baby swing by its own weight from one position to the other. A gentle push forward of the arms makes the child flop back with a jerk which might possibly damage its spinal column. Perform Schultze's movements at the rate of twenty-five to thirty per minute.

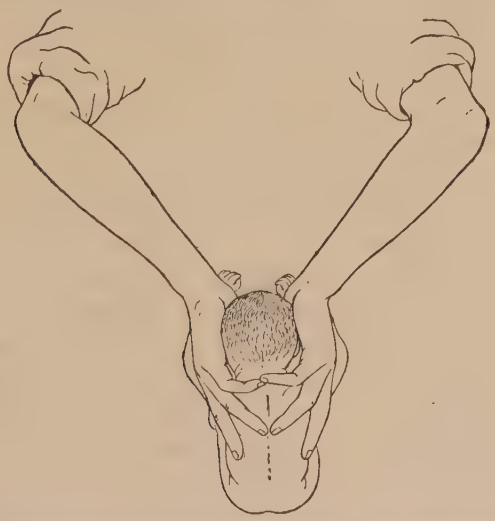


Fig. 280.—Schultze's artificial respiration. Expiratory position.

The objections urged against this method are—

1. Meningeal haemorrhage. This is probably due to the asphyxia and not to the artificial respiration.

2. Rupture of the liver. This only results from extreme violence.

3. Letting the child slip. This is due to faulty technique. The operator should be absolutely sure that his grasp is firm.

4. Fracture of various bones. If the child is held properly fractures cannot occur.

5. The cooling effect of rapid motion. This is counteracted by frequent immersions in the hot bath.

THE HEALTHY INFANT

General Introduction. Before leaving a case of midwifery, examine the child to see if it is physically defective,

Look into the mouth and see if there is cleft palate, or tongue-tie, examine the limbs, see that the anus is perforated, and if in doubt push a thermometer up into the bowel.

Having found the child normal, leave a few instructions about attention to it, and direct its progress day by day. Upon skill in the management of infants much of a doctor's reputation with the mother will depend. She is not capable of appreciating the true value of aseptic technique, but she is a shrewd judge of the welfare of her child.

We make, therefore, a few general remarks on the care of infants, for it will be necessary to form an opinion as to the health and condition of an infant in a very different way from that required for an adult. Only slight and transitory signs may be present to afford sufficient knowledge to direct treatment. Not only are physical signs in infants often transitory and difficult to interpret, but infants are exceedingly fickle in health. They may quickly change from normal health to serious illness, and often as quickly recover from apparently hopeless conditions. Therefore, be guarded in prognosis, and expect to meet with unforeseen disappointments and successes. The history that the nurse or mother gives is frequently distorted by a desire to hear a favourable report. Therefore put leading questions concerning the food of the child, its frequency and amount, whether the child suffers from flatulence, sweating, constipation, or diarrhoea. Do this thoroughly, no matter how simple the ailment appears to be.

Pay great attention to the fears expressed by the mother or the nurse, even if the child looks well. They are constantly watching it, and have every opportunity of noticing the finer changes in its face and manner, which are particularly significant indications of its health.

Make a thorough physical examination of a child that is said not to be well. Ask the nurse or mother to undress it. The mother may say that the child has just gone to sleep, or that the day is cold, but tell her its health is more important. Be gentle when examining, and do not frighten it. Have warm fingers and keen eyes. Finish the examination by light percussion, for percussion is apt to make a baby cry.

In spite of following out directions as carefully as the nurse has understanding, infants frequently experience periods of great distress, fretfulness, and ill-health. A careful investigation will almost always discover the cause, which will usually fall under the following heads.

It is essential to know what is a healthy child and how it should be tended. We will deal with the unhealthy child in the last chapter.

THE HEALTHY INFANT

The great majority of children are born healthy. Even the children of women dying from phthisis, heart disease, or starvation are frequently healthy in contrast to the perilously diseased condition of the mother. The natural law of care for the race, and indifference for the individual, is borne out by the healthy condition of the baby at the expense of the dying mother. Any one who sees a large number of the new-born children of the poor must be impressed by their capacity for health. They are firm, fat, and chubby. Nature gives them a good start. Their danger comes when they have to struggle with the disadvantages of civilisation.

A healthy child is plump, does not vomit, takes the breast or its bottle readily, is not flatulent, has the bowels opened three to four times in the twenty-four hours for the first month, and does not cry frequently nor long, certainly not more than half an hour continuously. Its temperature after the first three days should not be over 100° F., when taken in the rectum. The pulse is variable. The faeces are soft, and yellow, never green, nor have they white curds. The skin is without spots, and the tongue is clean without even one patch of white.

A healthy baby increases in weight about seven ounces a week, for the first two or three months, with the exception of the first week. Breast-fed children illustrate this rule with greatest uniformity. In bottle-fed children the growth is more uncertain.

The forehead should not be damp with sweat when the child is in its cot or perambulator. Sweating usually means that it is too heavily clothed.

Finally, the condition of the anterior fontanelle is an excellent guide. Normally it is level with the bones. In ill health it is sunk. More rarely in meningitis, and, it is said, before convulsions, it bulges.

When called in to decide whether a baby is healthy or not, take all these things into account. If there is any departure from the normal, look carefully for any irregularity or unsuitability in its management.

General directions for the management of a healthy child. We think the first three days of life exceed all others in importance. It is then that interference with the course of nature is frequent, and this, we believe, is always to the child's detriment.

Urine. The urine should be passed within the first twelve hours. Always inquire if this has been done. If apparently it has not, it frequently means that the nurse has let the napkin dry. Do not be alarmed so long as there is no spherical tumour (the bladder) above the pubes. Wash the orifice of the urethra with wet cotton-wool to free it of any smegma, give the baby a teaspoonful of cold water and put it in a hot bath. Pass the hand over the orifice of the urethra, and the stream of urine will be felt if any is passed. Even without this precaution there is no cause for anxiety if there is not a full bladder above the pubes. Direct the nurse to put hot flannels on the hypogastrium and carefully watch the napkins for the next six hours. If at the end of that time she is sure that the baby has not passed water, pass a sterile No. 1 silver catheter. This passes quite readily in either sex.

Meconium. The bowels should be opened about six times in the first twenty-four hours, voiding dark green meconium. If within twelve hours no meconium has passed, put the little finger, well lubricated, up the anus. If there is no imperforate anus, when the finger is withdrawn meconium nearly always follows. If there is an imperforate anus the obstruction may be felt. The operation for imperforate anus is described on p. 682. Meconium continues to come away for three to four days, after which the motions become pale yellow.

Condition of the child after birth. When the child is

born, its organs do not assume their full physiological functions at once, yet there is a profound physiological change. The lungs supply oxygen, but, even though a baby has cried lustily, full inflation has sometimes been found to be absent when the body has been examined in cases of infanticide. The new paths of the circulating blood take time to become completely established. The heat-regulating centre is very unstable, and, unlike the circulation, is less prepared for the new conditions. Above all, the digestive organs need a little time to develop efficiently their new functions.

Importance of the above. Crying is the most efficient means of inflating the lungs, so if a baby does not cry well during the first twelve hours it should be made to do so. This is more important with weakly children who have not given a lusty cry.

With regard to the heat-regulating centre, the child should be wrapped up at once after birth, unless precautions are taken to bring the child in front of a warm fire to allow it to kick about. Its bath must not be under 100° F.

The abuse of the digestive organs is a common offence.

Too frequently after birth, a little castor oil, some butter and sugar, milk and water, or the top of gruel is given to the child. We strongly disapprove of these practices. The welfare of the healthy child of a healthy mother can be best promoted by adhering to the course of nature. The milk does not enter the breast until the third day of the puerperium. A little colostrum is secreted, and we believe its purpose is to accustom the baby's stomach and digestive organs to the function of digestion. It is probable that colostrum contains antigens, or some similar substances, which are capable of exciting the tissues to secrete the antibodies necessary for the assimilation of food. It is therefore most desirable that a new-born child should be supplied with colostrum. Whether the colostrum has or has not a laxative action seems to us unproven.

We have already mentioned that, if the cord is not tied until pulsation has ceased, some three ounces of blood pass into the infant, which otherwise would be lost. The body contains more blood at birth than it does at the end of three days. The child must consume this before the establish-

ment of the flow of milk. *We insist that neither medicine nor food, except colostrum, should be given until the time when the maternal milk supplies its needs.*

(We are experimenting at present with supplementary feeding, *i.e.* the baby is offered an extra feed after each occasion at the breast. We have not yet got our complete data, but it appears as if the loss of weight so commonly found at the end of the first week will be diminished by this method.)

Early flow of milk. In some cases the milk is abundant on the second day. This is too soon, and the child is apt to take too much and so get indigestion. Put it to the breast sparingly to prevent this.

Late flow of milk. In other cases the milk does not appear until the fourth or fifth day. The baby gets hungry and cries. In this case we have found one part of milk to three parts of water will meet the condition. The milk frequently becomes very scanty at the end of a week. Many mothers discontinue nursing on this account; this is a great mistake. If plenty of fluid is taken, as a rule the milk returns in twenty-four or thirty-six hours, and the enforced fast is beneficial.

Breast-feeding. The importance of breast-feeding cannot be over-estimated, and the physician should use all his influence and tact to persuade the mother, her relatives, and the nurse, as to its necessity. Remember that the welfare, and even the life of the child, may depend on persistent firmness in this matter. Every conceivable argument will be employed to make the doctor yield to the desire of the nurse or of the mother to get the infant into bottle-feeding. If this is done for other than convincing reasons of necessity, let the responsibility rest on others. Not one woman in forty need fail to nurse, and not one child in a hundred will benefit by being deprived of mother's milk. Healthy infancy promotes health and strength in the adult, and parents little realise how greatly future welfare depends on freedom from infantile complaints.

Sound teeth, well-formed features, good physique, vigorous digestion, are the usual legacies bequeathed to those fortunate enough to pass through a normal infancy.

To ensure the best results it is necessary to supply the infant's system completely with its wants, which are the ferments, the vitamins and the other substances known to exist in warm recently secreted human milk, and which are entirely absent from artificial modifications of it.

It must be admitted that, even with the best will on the part of the patient, breast-feeding is often a source of worry, anxiety, and disappointment to the mother and a source of much complaint on the part of the nurse.

An infant may not be able to grasp the nipple, or may fall asleep after a few moments of suckling, only to cry vigorously when removed from the breast. The child may vomit immediately after the breast, or there may be a movement of the bowels after each feed. This will be accompanied by crying, flatulence, and crampy indigestion. A popular remedy for these several conditions is to substitute bottle-feeding in part, or in whole, for that of the breast.

An alternative method is :

(*a*) A supplemental feed by spoon or bottle after each breast feed.

(*b*) Giving the mother a rest every two feeds during the day, and giving a bottle feed at these times, the quantity to be determined after taking test feeds.

It often requires care, diagnostic ability, and much patience to determine the true state of affairs. If an accurate scales is procurable the child may be weighed before and after breast-feeding to determine the actual amount it receives at any meal. It is useless to try this plan on the ordinary spring scales, and many mistakes arise from dependence on their accuracy. A posseting child, suffering from irritative stools passed after each meal, is certainly getting more nourishment than it can digest. This is also probably true of a posseting child who is at the same time losing flesh. Should the infant show a clear loss of weight in the second week without any sign of putting back food, it is permissible to conclude that the mother's milk is either too weak, or present in too small amount. Appropriate steps must be taken to improve the amount and quality of the milk, and

to tide over a temporary deficiency; fresh cow's milk may be employed. There is no simpler or more efficient plan than the following:

Bring a small quantity of milk to boiling point in an open saucepan; cool rapidly to blood heat and give one, two, three, or four teaspoonfuls after the infant has exhausted one breast. Begin with one teaspoonful and gradually increase as required. Do not add sugar or water to the milk, and employ this method rather than that which allows both breasts to be used for the same meal.

From experience of its practical utility we greatly recommend this plan. Its advantages are very apparent. It obviates the complications of bottles, and prevents the mother being discouraged in her efforts to nurse, as she always will be when she sees bottles employed. The fact that the milk is not sweetened is a safeguard against the infant taking more than it requires, and the milk already extracted from the breast has the undoubted power of revitalising with ferments and lipoids the dead milk with which it is mixed. If the breast is deficient in quantity as well as in strength the infant will require sips of water, not mixed with the milk but given mid-way between meals. This water should not be given out of a bottle, nor mixed with sugar. If the child requires it, it will be taken, but if sweetened the infant may still take it even when not required.

To supplement mother's milk with any of the proprietary foods has the demerit that all these foods are extremely sweet and for this reason are preferred by the infant to its natural nourishment. After partaking of a bottle containing any of them, it is sometimes found quite hard to induce the child to nurse vigorously from the breast.

An alternative plan is to test the feed and supplement the deficiency. Another method of dealing with the case is to give the baby two bottles daily to give the mother a rest. After a week it may be possible to feed the infant entirely on the breast.

The new-born infant is almost devoid of instinct and will not hold the nipple unless compelled by hunger to do so. Hunger is not experienced for the first three days, and the

nursing mother is puzzled and distressed by the infant's inability to discern its duty.

If the nipples are well developed a little persistent patience will put matters right; but in the event of their being depressed, the lesson is learned only after much crying on the part of the child, and many tears on that of the mother.

One frequently hears the catch-words "equality of opportunity" in the speeches of our politicians, but there can be no equality of opportunity so long as physical defects and the baneful results of ignorance and neglect of the young child are allowed to persist. It is computed that 100,000 infants perish within the first year of their birth in the United Kingdom, and the vast majority of these die from neglect, whether criminal or the result of ignorance.

Whether women are able to compete with men on equal terms, in the trades and professions which have arisen through men's energy, is a question which it would be out of place to consider here; but there is one occupation which quite certainly falls within the province of women's work, namely, the care and up-bringing of the infant, and in this they have largely failed.

It is more important to keep an infant in health throughout the first week of life than throughout the second; and throughout the second week than the third, for the earlier disease attacks the young the more permanent will be the results. Bad teeth, ill-developed jaws, unsightly features, crooked bones, diminished physique, intellectual incapacity, and want of energy, are the results, in many cases, of neglect of child-life.

The tragedy of infancy lies not so much in the death-rate as in the number of lives which barely worry through the struggle for existence.

Some years ago a leading Liberal statesman asserted that throughout the British Isles ten millions of people lived on the verge of starvation. Even assuming these figures to be exaggerated, yet still an enormous number of this depressed population will be found to consist of effete derelicts, who lack the intelligence, the physical power, or the energy, to assert their right to live comfortably. From the cradle to the grave they are improperly fed and educated.

The obstetrician has not fulfilled his duty if, in addition to skilful attendance during the lying-in period, he does not impress on the mother and on the nurse the all-important principles which make for healthy infancy.

Times of feeding. Put the child to the breast within six hours after its birth if the mother is awake. Twice in the first twenty-four hours, three times during the day and once during the night for the second twenty-four hours, suffice. Give it teaspoonfuls of water if it cries from thirst. From the third day onwards let it take the breast every three hours during the day and once during the night. Thus it is fed at 7 a.m., 10 a.m., 1, 4, 7, 10 p.m., and 3 a.m., counting from the beginning and not the end of each meal. While these are the times we have hitherto advocated, we have lately had much success with a four-hourly interval. With this method the times of feeding are 6, 10, 2, 6, 10, and some babies require in addition a feed in the middle of the night. Decide on one of these methods and insist above all on regularity. Wake it up if it is asleep at the appointed time. Sometimes it is difficult to wake, or if sleepy it refuses to take the breast. If so, let it sleep until the next appointed hour has arrived. The discipline of regularity in meals is good for children, as for adults, and lays the foundation of good health and temper.

A child has a tendency to sleep by day and be wakeful at night. This tendency can be counteracted to the advantage of the parents by feeding once only during the night. Once give way to crying and allow the child to be fed at night, and there will be little peace. In plain words, we think it necessary to gain the upper hand, and not be bullied by irregular clamouring for food. The child, if dealt with in the manner we advocate, soon falls into the paths of discipline, and gains thereby the advantages of a well-ordered mode of existence. Its digestive juices are secreted with periodical constancy, and this periodicity is not upset by the offer of the breast whenever some capricious fancy causes the child to cry. The function of digestion also has timed periods of rest, the importance of which has been shown by the fact that, if a man of regular habit takes a meal at an unwonted hour, it will frequently remain

unattacked by the digestive juices until the customary meal hour arrives.

Upon digestion depends health, upon discipline stability of character, and we do not think these foundation-stones of a useful life can be laid too early.

Method of breast-feeding. When the mother is in bed, she turns on the side of the breast which is to be used, and gives the nipple, which has just been washed with a piece of cotton wool and warm water. She must be careful not to jam the child's nose against the breast, so that it cannot breathe freely, whilst sucking. Sometimes, when the mother and nurse report that the baby is too weak to suck, this is the true reason, and it can be detected by watching the nursing. Put the child to one breast only for a feed. The other breast is used for the next feed. If only one breast can be used it is better to give the bottle alternately, for the milk that is secreted by the breast every three hours is generally too thin and poor in quality. Twins should have alternate breasts in case one breast is better than the other, except in the case of one twin being markedly weaker—give it then the good breast at all times.

How much shall be given? Our rule is—and it applies to both breast and artificial feeding—let the child have as much as it will take without posseting. If its stomach is too full the extra quantity will be posseted. When it possets, give it less next meal. Judge of the amount swallowed by the duration of the meal. If it feeds for twenty minutes and possets, feed for fifteen minutes the next time, and so on until the longest time without posseting is found. This is a practical plan, but has the disadvantage that enlargement of the stomach might occur from over-distension. A simple rule to follow in bottle-feeding is :—Allow 2 oz. per lb. per day if fed on full milk, *e.g.* an 8 lb. baby will require $8 \times 2 = 16$ oz. milk per day. If the food is diluted the amount is $2\frac{1}{2}$ oz. per lb. per day.

Weigh. The infant can be weighed before and after a meal to determine the amount taken.

Care of the nipples. Let the nipples be washed after suckling, with boric lotion, and then dabbed with a little weak spirit (eau-de-Cologne or brandy-and-water equal

parts) to prevent maceration of the epithelium. Before feeding, the nipples are washed with warm water.

The nipples may be depressed, yet it is astonishing how a baby will draw them out. Speaking accurately, the action of a baby's mouth is rather to press back the tissues away from the nipple than to draw it out. This action the mother can also aid by pulling back the tissues around the nipple with her fingers or pressing them back with an umbrella ring. If the baby cannot get the nipple, let it try daily, and let the nurse draw the nipple gently out with clean fingers several times a day. Use a nipple shield, as when the nipples are cracked. Between feeds keep the nipples covered with the shields illustrated on p. 181. In bottle-feeding the greater suction force necessary causes a negative pressure in the mouth, and tends to depress the nose, and to cause a highly arched palate.

Attention to the nursing mother. Nursing women tend to eat too much. This is especially harmful during the lying-in period. They are encouraged to over-eat, and this brings on indigestion. Tell the nurse to regulate the time and quantity of each meal. Keep the patient's bowels regular by giving plenty of fluid, fruit, and green vegetables, and, if necessary, by cascara, senna, or other non-irritating laxative. We know the popular objection to fruits and green vegetables, but we have never found any bad results from their use.

If the milk begins to run short give the mother more fluid. There is a popular fallacy that milk given to the mother comes out as milk in her breast. This leads to the mother drinking milk between her meals, which takes away her appetite and causes indigestion. Again, there is a popular notion that stout and beer given to the mother produce more milk in her breast. This is probably right, for by drinking stout or beer she gets more fluid. Water is equally serviceable, the essential thing being the ingestion of fluid.

Nervous shocks, too many visitors, and the unwise statements of nurses, all discourage a woman from efficient nursing. She is told that she will not be able to nurse, that she is too delicate, or that her child is too strong. The nurse not infrequently says that the baby is cross and

flatulent, or that it is having too little milk. Do not give way to these suggestions, but urge the regular breast-feeding, and be very chary of any change. Finally, a nervous woman may find nursing very painful. Point out to her the great advantage breast-feeding is to her child. Even a week at the breast is a great advantage.

Lactagol, a preparation derived from cotton seed, has attained a great reputation in increasing the flow of milk. It is given in teaspoonful doses, in milk, three times daily. A small bottle of Guinness' stout twice daily is even more useful as a galactagogue.

Mother's milk, drawn off by a breast-pump and injected by a hypodermic syringe into the cellular tissue of the breasts, is also said to be efficacious. The dose is from three to four drachms. We have had no experience of its use. We have had some slight success with proprietary preparations containing placenta and mammary gland.

Times of feeding in later months. If possible, the interval between feeds should be four hours from the commencement. If, however, the baby is under 7 lbs. weight, it may be necessary to start with a three-hourly interval, which should be changed to four hours at the beginning of the fourth month.

Drugs excreted in mother's milk. This has been referred to on p. 183.

Women who cannot nurse.

1. Women who have some general disease such as phthisis or heart disease.
2. Women who have no milk. Very rarely women have no milk; more commonly deficient milk is due to keeping the baby from the breast and avoiding the stimulus of suckling.
3. Women with sepsis.
4. Women with interstitial mastitis.
5. Women who are insane.
6. Women who have lost a considerable quantity of blood during labour.
7. Women whose health is genuinely injured by lactation.
8. Women who have to go out and work for their living.

A syphilitic woman can nurse her own infant safely. Finally, some women refuse to nurse their children for personal reasons. Urge upon them that their breast-milk belongs to the child, and emphasise the risks of artificial feeding.

How to stop the flow of milk. The best way to do this is to smear belladonna ointment on lint and apply it to the breasts. A tight binder is then applied. As an alternative, a belladonna plaster is used. Give also a concentrated saline purge. Should the breasts swell and be tender, use the breast-pump sparingly, withdrawing but a drachm of milk. This will relieve the pain, and seldom has to be repeated. Acetate of potash, twenty grains three times a day, is also recommended. It is stated that under this treatment the engorgement of the breasts rapidly subsides. We have not employed it because it seems to have no advantage over the treatment described above.

The gradual drying up of milk can be brought about by substituting an ever-increasing number of bottle-feeds for that of the breast. In this way the breasts are kept for long periods in tension, without being allowed to become painful, and they soon cease to function.

The frequent and prolonged use of the breast-pump, or massage, is wrong in theory and harmful in practice. Potassium iodide in 20-grain doses is often used.

Children that must be spoon-fed.

1. Children with unoperated cleft palate, or bad hare-lip.
2. Children with syphilitic and painful ulceration round the mouth.

Wet nurses. It is hard to get a respectable woman as a wet nurse. Sometimes, if the infant cannot be got to progress by any other way, wet nursing may rear it, but such cases are rare, and the milk of the wet nurse in many cases does not suit. The essentials of a wet nurse are that she should be free from all suspicion of disease, especially syphilis, that her breasts should be healthy, that her teeth should be sound, that she should be of respectable and orderly habits, that her own child should be much the same age as the child to be suckled, and that it should be healthy.

Artificial feeding. Cow's milk is the most convenient and best food for infants in the absence of human milk. Ass's milk is said to be better, but it is seldom available. Goat's milk can be recommended, but it, too, is difficult to obtain.

Differences between cow's and human milk. Recent researches have shown various differences between human and cow's milk.

Cow's milk contains two to three times as much protein as human milk. This protein occurs in two forms, casein and soluble protein (lactalbumin).

Casein is a protein containing phosphorus combined with lime. It is not coagulated by heat, but is thrown down in the form of curd by acid or rennin.

The soluble proteins are the most readily digested of all forms of albumin. They are present in relatively greater amounts in human than in cow's milk.

Sugar occurs as lactose in both, but in human milk it is two to three times more abundant than in cow's milk.

The amount of fat is about the same, but human milk contains a greater proportion of fat with a low melting point and therefore of greater digestibility.

Lecithin, a constituent of nerve structures, is greater in amount in human than in cow's milk.

Human milk contains citric acid and cow's milk does not. Human milk is also alkaline or faintly acid in reaction and quite sterile.

Cow's milk is acid in reaction from the bacteria it contains, which may amount to 200,000,000 per c.c. Even when obtained by the most modern aseptic methods a limit of 12,000 bacteria per c.c. is permitted.

But above and beyond these chemical distinctions, there are more subtle differences. Newly-born animals are poorly supplied with complement and antitoxins to enable them to repel germ invasion, or to assimilate food.

It is now suggested that tissue cells can assimilate nourishment only through the intermediate agency of special antibodies. The early milk of a cow is rich in antigens, substances capable of exciting the formation of antibodies in

the calf. In calves fed from later milk these antibodies are not found.

Again, it is almost impossible to rear guinea-pigs weaned from the first, but if they suckle the mother for three days, 90 per cent. can be reared after weaning.

Experience in infant-feeding points strongly to similar conclusions, namely, that the colostrum and early milk have the power of exciting a beneficial reaction in the infant's tissues.

How to alter cow's milk to make it like human milk. There are two definite methods—the caloric and the non-caloric. We shall deal first with the former.

It is essential to know the constituents of human and cow's milk.

	Protein.	Sugar.	Fat.	Ash.	Water.
Human .	1·5%	7·0%	3·5%	0·20%	87·8%
Cow . .	3·5%	5·0%	3·5%	0·7%	88%

If the table is referred to, and the relative proportions of the three main physiological constituents are considered, if equal parts of milk and water are taken, the various percentages in cow's milk will now read:

Protein.	Sugar.	Fat.
1·75%	2·5%	1·75%

Theoretically, the protein now is near enough to human milk standard, but the fats and carbohydrates are reduced too much. Take, therefore: milk 10 oz.; cream 15½ per cent. 1 oz.; sugar 1 oz.; water to 1 pint. This will give the correct percentages.

The next question is—how much milk and water should be given to a baby? The food requirements of the body are conveniently stated in calories. One calorie is the amount of heat required to raise one kilogramme of water 1° Centigrade.

During the first six months the average child requires fifty calories per pound of body weight per day.

Take a hypothetical baby, one month old, weighing 8 lbs.: 8×50 = caloric requirements = 400 calories.

The caloric value of 1 oz. cow's milk is approximately 20. Therefore $\frac{400}{20}$ = amount of milk mixture necessary in twenty-four hours, 20 oz. Refer to mixture above.

How does this mixture conform to caloric requirements?

Milk	10 oz. =	200 calories
33% cream . . .	1 oz. =	90 ,,
White sugar . .	1 oz. =	110 ,,
		400 ,,

In reality we think this diet deficient in some respects, but children do very well on it for a start, and it is very easy to add milk as the child progresses, whereas it is difficult to cure dyspepsia caused by a too rich diet.

The reasons for advocating dilutions at the start, and only working up by degrees to fuller or full milk, are that many children do well apparently for two or three months on full milk, and then become dyspeptic and lose weight, passing white motions, owing to an intolerance to milk from the use of too rich a milk mixture.

The non-caloric method. Having decided to use cow's milk, a method of altering it must be adopted.

1. The protein, or curd, is two to three times as abundant in cow's as in human milk.

2. The fats in cow's milk and human milk are in about the same proportion.

3. Human milk contains two to three times more sugar than cow's milk.

4. The curd of cow's milk forms larger and harder masses than that of human milk. Barley-water mechanically divides up the curd of cow's milk. Citrate of soda, one grain to every ounce of milk, or the use of lime-water in place of barley-water, makes the curd more flocculent.

5. The cow's milk is acid from bacteria, while human milk is alkaline or only slightly acid. The less cow's milk is allowed to stand, and the fresher it is, the less acid it will be. It is best kept in covered earthenware jars in a cool place. Sodium bicarbonate, although it makes the milk less acid, is not a natural constituent of milk. Lime-water makes the curd more flocculent and diminishes the acidity.

6. The bacteria are destroyed, as far as possible, by some form of Pasteurisation or sterilisation, but boiling destroys the lipoids, the ferments, and throws a large percentage of phosphates out of solution.

The mixture. We have found the following mixture the most convenient and easy to make up—

Milk	$1\frac{1}{2}$ oz.
Cream (15 per cent.)	1 oz.
Lime-water	$\frac{1}{2}$ oz.
Solution of sugar of milk . . .	$1\frac{1}{2}$ oz.
Citrate of soda	3 grains.

How to give the mixture. Do not give this undiluted mixture until the third day. During the first twenty-four hours give the baby the mixture with three parts of water for one feed. During the next twenty-four hours give it for two or three feeds. This dilute mixture is intended to take the place of the colostrum. On the third day use the above mixture as a substitute for breast-feeding. We think children up to one month old do as well, if not better, on this mixture, as on any other method of artificial feeding. The milk mixture is always Pasteurised before use. The quantity required will be between one and three ounces for each meal.

Its constituents. Barley-water may be substituted for lime-water. *Barley-water* is made by adding two teaspoonfuls of well-washed pearl barley to a pint of water. Boil to three-quarters of a pint and strain. It must be freshly made morning and evening.

Some paediatricians disapprove of giving barley-water (starch) before the sixth month. We have seen no ill effects from its use.

Lime-water is a saturated solution, and is made by shaking up unslaked lime with water in a clean bottle. Let this stand, and pour off the supernatant, clear fluid. It is better to make lime-water than to buy it.

Milk sugar can be bought from chemists. The solution is made by putting three ounces of milk sugar into a pint of hot water. Keep it in a corked bottle after Pasteurising for ten minutes. Dark Demerara sugar does almost as well, but has twice the sweetening power and strength, and is more liable to ferment and to cause flatulence.

Cream that has been centrifugalised at the dairy contains between 40 and 45 per cent. of fat. If the centrifugalised

cream cannot be obtained, set aside some good fresh milk for about six hours and skim off the cream. This will contain about 15 per cent. fat.

When the child is a month old. If undiluted cow's milk suits the baby, it should be given, but if the mixture is agreeing, it should not be changed.

Feeding with pure cow's milk. This gives the correct amount of fats, and the sugar added makes up the correct amount of carbohydrates. The casein is in excess: this excess is passed per rectum. The stools become whitish: if they become uniformly white, this is a danger signal that the mixture is too rich. Some children will thrive well on pure milk, whilst others do well for some weeks or months, but then develop dyspepsia, evidenced by failure to gain weight, white stools, etc. In giving full cow's milk, smaller feeds should be given in each bottle. There is rarely constipation. The milk and the milk mixture given throughout the first month are always Pasteurised before use. Boiling impairs its nutritive qualities, whereas Pasteurisation does so to a much less extent. It does not kill spores, and in some instances babies have died of acute choleraic diarrhoea, although fed only with carefully Pasteurised milk. These cases are very rare, and the better nutritive qualities of this milk, compared with those of boiled milk, warrant the risk of such rare disaster. By Pasteurisation most organisms, among them the tubercle bacillus, the typhoid bacillus, and the bacillus coli, are killed. We add citrate of soda to the whole milk in the proportion of one grain to the ounce, as in the mixture, up to three grains.

Water and times of feeding with pure milk. Pure milk, as we have stated, is deficient in fluid, therefore the baby wants water between meals, and is given it with a teaspoon. The feeds need not be frequent. The intervals should be as already stated.

Method of Pasteurisation.[1] The best apparatus is a Soxhlet's milk Pasteuriser. It consists of a cruet-stand which holds ten bottles and fits into a saucepan. The milk or mixture is poured into the bottles, one feed in each,

[1] Strauss's apparatus for Pasteurisation is also very convenient. Directions for use are given with it.

which will mean between $2\frac{1}{2}$ and 5 ounces the first six months, and between 5 and 10 ounces the second six months. Cover the mouth of each bottle with the little rubber cap. Pour water into the saucepan until the bottles are three-quarters immersed. Then raise the water to boiling-point. The milk does not itself boil. It only attains to a temperature of 160° to 170° F. at the end of ten minutes. The mixture is kept in the boiling water for ten minutes, for a longer exposure diminishes its nutritive qualities by raising its temperature nearer to the boiling point. It is best to prepare the milk morning and evening. The rubber cap, which gets sucked a little into the mouth of the bottle as the latter cools, keeps the air from the contents. Cool the milk rapidly by plunging the bottles into cool but not cold water, for bottles are apt to crack if very hot and plunged immediately into absolutely cold water. Keep them in a cool place.

Giving the bottle. When the child is to be fed, the nurse takes the bottle, warms the milk in it by putting the bottle in warm water, removes the cap, and with clean fingers fits on a rubber teat. These rubber teats she cleans inside and out and boils for half a minute before use. After use the teat is washed in cold water, rubbed clean with salt, rinsed in hot water, dried and replaced in the teat box. The latter is made of cardboard with perforations in the lid: this prevents deterioration of the rubber. The child is fed straight from the bottle. There is, of course, no air vent, but it manages its feed successfully, releasing the teat occasionally to allow air to enter. If it seems to have difficulty, see whether the hole in the teat is large enough. Twenty minutes should be taken over a feed, and not longer than half an hour. It must always be fed, never allowed to suck the bottle in its cot, sleep, wake, and suck again.

After the sixth month. The first teeth appear about the sixth month. At this stage starch may be introduced into the feeds if this has not already been done; as already stated we see no objection to using starch early in life. Use, for instance, Neave's, Mellin's, Benger's, Frame Food, or oat-flour. The directions for preparing the patent foods will be found on the tins. If the food is to consist of oat-flour and milk, a tablespoonful of oat-flour is used to half a

pint of milk. Mix the oat-flour to a smooth paste with a little of the milk, gradually adding the remainder. The vessel containing the mixture is placed in a saucepan of water, which is boiled for ten minutes. The food is cooled rapidly.

Food for poor children. The mothers of poor children are unable to make the mixture we advocate, or to buy a Soxhlet's Pasteuriser. Give them a bottle of citrate of soda, and they can buy some Demerara sugar.

After the second day, then, such children have as artificial diet :—

Milk	℥jss
Barley-water . .	℥iij
Demerara sugar . .	One smoothed teaspoonful
Citrate of soda . .	Gr. iij

Citrate of soda causes a portion of the casein to be thrown out of action as a food, and to pass through the intestines as a stimulating ash. Discontinue its use if the food requires to be strengthened. Citrate of soda may cause constipation, and large doses occasionally result in oedema.

They can put the mixture in an ordinary bottle and put the bottle into a saucepan of cold water. Then boil the water in the saucepan for ten minutes. If this cannot be managed they can put the feed in a small saucepan, heat until the milk rises (170° F.), and let it cool rapidly by putting the saucepan in cold water. The mixture should be kept in a clean corked bottle put to stand in cold water.

Keeping the bottles and nipples clean. This is an important part of infant feeding. The remnants of milk about the nipple or in the bottle form food for bacteria, which are ingested and may cause gastro-intestinal infection.

The bottles are rinsed in cold water, scalded inside and out before and after feeds, and kept in a solution of soda when not in use. The bottle must never have any rubber tubing. It is better to keep two bottles in use, and they should be boiled at least once a day.

The teats should be thoroughly rubbed inside and out with common salt, to remove the milk slime, immediately after each feed, and then well rinsed. They are kept in a perforated cardboard box of such a depth that the tips will

not reach the lid. This method preserves the rubber. Before using, they should be boiled for a minute or two.

Position of the baby whilst feeding. Let the nurse always hold the baby on her arm. As we have said, it must not have the bottle in its cot.

Mixed feeding. The question of supplemental feeds in the event of there not being sufficient breast milk.

Test feeds should be done for every feed for a day, to ascertain accurately at what period of the day the mother's milk fails.

Two methods:

Method A. Supplementing after every feed. A child three months old requires 4 oz. per feed. If, after weighing before a feed and after, one finds the child has only received 2 oz. from its mother, 2 oz. of milk mixture should be given. Similarly, if the child only receives 1 oz., 3 oz. should be given, and so on.

Method B. As mentioned above, it is necessary to ascertain at what periods of the day the mother's milk is most lacking. This will be found to be about the middle of the day. Accordingly, we have obtained very good results when the baby is fed at three-hour intervals, by the following: 6 a.m. breast-feed; 9 a.m. bottle-feed; 12 noon breast; 3 p.m. bottle; 6 p.m. breast; 10 p.m. breast. In the above it will be noted that the mother has a rest between six and twelve, and twelve and six.

Weaning. Start to wean the child at the ninth month. The child by this month should be thoroughly accustomed to starch, having had groats once daily for the past two months, and some other foods with milk during other feeds.

Begin with one spoon-feed of whole milk once a day. If the child keeps well, give it alternate breast and spoon feeds. Sometimes it is convenient to give the bottle instead of spoon-feeds, and it is then weaned from the bottle at twelve months, weaning thus taking two to three months.

Do not wean a breast-fed baby in hot weather, when diarrhoea is prevalent, but wait until the period of summer diarrhoea has passed.

It is necessary for the mother to know what diet the child should have at one year old.

6 a.m.	8 a.m.	12.30 p.m.	4.30–5 p.m.
Orange juice ½ oz. with water. Rusk.	Porridge or groats. Half lightly boiled egg four days on milk with breadcrumbs; the others, bread soaked in bacon or other fat.	Bone and vegetable soup 2 oz. One teaspoonful of sieved potato and greens. Milk pudding. Apple sauce.	Milk 6–8 oz. Rusk. Biscuit.

10 p.m.
4 oz. milk if necessary.

It is not possible to get straight on to this diet. Start at 12.30 with a spoon feed, and as the child becomes accustomed to it, give also at 8 a.m. By the time the child is one year old, it should be completely off bottle-feeding and also off the 10 p.m. feed.

There is no need to stop nursing because the mother begins to menstruate, unless the milk disagrees with the baby. Statistics show an undoubted change in the weight curve during menstruation, but this is no reason to stop nursing.

General conditions of an infant's welfare

Fresh air. Fresh air is very important to health. We advise that the baby should be taken out into the fresh air after the first day, unless rain is falling or the air is damp or very cold. The sooner it is put in a perambulator the better. It will get more fresh air in a perambulator, for it is less tedious for a nurse to wheel a perambulator than to carry the baby, and consequently she will stay out longer. It is good, we think, to keep it out in the sun all day, except at meal-times, but the eyes and face should be carefully shaded from direct sunlight. If the child is well wrapped up, it will not catch cold. It should lie on its back, for this is the natural position.

The nursery windows should be open night and day, winter and summer. They may be closed whilst bathing, although we know from experience that children do not catch cold if the window is open.

The bath. To avoid wetting the cord, it is advisable to

give a shallow bath until it has separated. The child is not submerged in a shallow bath. Soap, after the first bath, should not be used with a very young child. Rubbing with a towel is too severe for the delicate skin. It should be dabbed with a warmed towel to dry it. After this, the groins, buttocks, and armpits are dusted with some powder such as boracic acid 1 part, zinc oxide 3 parts, starch 6 parts. Fuller's earth may possibly contain tetanus bacilli, and is therefore not advised.

When the cord has separated, the baby gets a bath in the morning or evening, depending on the convenience of the house. The temperature of the water should be about 98° F. The nurse should never immerse the head, but should hold it with her left hand.

Care of the eyes and mouth. In a healthy child the eyes should be sponged with cotton-wool wipes and warm water night and morning. The mouth may be cleansed three times a day with soft linen or cotton-wool and warm water. The nurse wraps the linen or cotton-wool over her little finger and gently wipes out the mouth.

The nose should be cleansed with moist swabs in equal parts of glycothymoline and water.

Care of the cord. The cord is dressed daily. It is first dusted with the powder. A piece of scorched gamgee tissue or scorched linen is then cut half-way down the centre, or a hole through which the cord can pass is cut in it. The tissue is drawn round the cord and folded over it with its scorched surface to the cord. It is kept in its place by the binder. By keeping the cord dry separation is best effected. Sometimes a small weeping surface is left. Treat this with equal parts of hydrogen peroxide and water, then silver nitrate 3 per cent., two or more drops, and finally with a dusting powder.

Care of the prepuce in a male child. The prepuce should be pulled back a little each day by the nurse, and the surface of the glans sponged. In a few days the nurse will be able to retract the prepuce completely. From that time, whenever the baby is bathed, the prepuce should be drawn back and the glans cleansed. If the prepuce is tight, circumcision is advised: in fact it is wise to suggest

the operation to the parents in case they would like to have it done to prevent trouble in later years.

Sleeping. We advise that an infant should be kept, when indoors, in a separate cot, except at meal-times. If it is nursed to sleep in the mother's bed, it will get accustomed to this soporific form of nursing, and cry and be wakeful without it. Above all, do not allow curious visitors to handle the baby constantly and to spoil its sleep. Let it be put back to the cot immediately after a feed. Jigging after meals is very harmful. The room should not be specially warmed or the child treated like a hothouse plant. The ordinary temperature that suits adults suits children just as well. A child should sleep with its face exposed to the air, not covered by a blanket, or thick veil, when in its perambulator.

Clothing. The principal fault in children's clothing is that it is too thick. When the clothing is too thick the child perspires. The forehead is moist and the child is often fretful. Nor should the clothing impede the movements. It must not be tight round its chest or abdomen. Exercise is important to progress, therefore the child must be able to kick freely and to move its arms.

Crying. A healthy child does not always cry because it is hungry. It may be thirsty. Giving it two or three teaspoonfuls of cold water will quickly decide the point. If this does not stop its crying it may be too hot, or its feet may be cold; its napkin may be wet or soiled; a pin may be running into it; a flea may have bitten it, or it may be fretful from too much attention, when it wishes to sleep. A change of position in the cot will often stop the crying. If it continues to cry, remember that crying is one of the chief signs that a child is not well.

General information about the normal child.

At 6 weeks a baby begins to observe and to hear. If it turns at a sound, it is not deaf and will not be dumb.

At 3 months it holds up its head.

At 6–8 months the two lower central incisor teeth appear. The four upper incisors next appear between the ninth and twelfth months.

At 8 months it should be trained to go without napkins. They should at first be removed for several hours and then replaced. It will get accustomed to regular habits in this way.

At 12 months the child begins to walk.

At 12–18 months it begins to talk.

N.B.—*Fruit-juice, or turnip juice, cod-liver oil, fresh air, and sunshine are all necessities for health in an infant.*

Fig. 281.—Giving rectal saline to the infant.

Care of premature children. Premature children are apt to do well for a week or so and then to die suddenly. We think the principal reason is want of fluid. They require to be kept warm in gamgee tissue, or in an incubator, to imitate the heat of the uterus. They perspire and so lose fluid, as well as by passing urine and faeces. The stomach is very small, and they may take nearly an hour to swallow a teaspoonful of fluid. Hence our rule is to give water by enemas, as well as fluid by the mouth. Our hospital routine is:

To try to get some breast milk or colostrum, and feed

$2\frac{1}{2}$ to 3 hourly, eight feeds in the twenty-four hours. Failing this, there is a choice of mixtures.

1. Protein milk—made by taking 1 quart of milk and 2 teaspoonfuls of rennet, and bringing to blood heat. Stir until the milk clots. Strain through butter muslin. Take the curd and rub through a hair sieve, using 1 quart of water to aid clots through fine mesh. Do this three times, add back the whey and give with or without sodium citrate according as the child is able to manage.

2. Another useful mixture is one part milk, one part whey, two parts water. This proportion is changed to suit the case. Peptonising milk is also useful.

From the fourth day, give enemas until the baby is taking enough fluid. They are given as follows :—The baby is held up by the feet, and the fluid is injected very slowly with a ball syringe (see Fig. 281). The buttocks are then closed over and kept so for two minutes.

The milk flow should by now be established. If not, give one of the milk mixtures.

Failing an electric or a gas incubator, a high and equable temperature can be obtained by means of an improvised incubator. The infant is rolled in cotton wool, placed on a warmed feather pillow, over which a large pillow cover is drawn so as to include the infant. A drawer from a chest of drawers is then placed with its cavity pointing towards the fire, and its bottom placed so as to form a screen against draughts. Beneath the pillow are placed three hot jars, and in the box or drawer is hung a room thermometer. This should register a heat of from 80 to 90° F., and an equable temperature is maintained by the adequate renewal of hot jars.

THE UNHEALTHY INFANT

We have described the healthy child and dealt with its management. We have now to deal with the unhealthy child. Frequently the signs of illness are so obvious that, when called in consultation, one immediately sets to work to discover what is wrong. But at other times the signs are so indefinite that they may hardly awaken suspicions. The mother, eager to do the best for her child, brings it to

the doctor at fixed periods in order to assure herself that its progress is satisfactory.

How to judge the progress of a child by weight. A healthy child should not put on less that 4 oz. a week for the first three months of its life, and 7 oz. is about the average. A child should double its weight in the first six months, and treble it by the twelfth month, *i.e.* a 7-lb. baby should at six months be 14 lbs., and at a year 21 lbs.

How often should a child be weighed ? Once a week for the first three months of its life, and less frequently later. Remember to weigh it with the same amount of clothes and at the same time of day, and not before a meal one week and after a meal another week.

Gain in weight with bottle-feeding. Frequently there is very little gain in weight for the first month. Provided the child shows some increase in weight it is progressing satisfactorily.

Significance of the weight. As has been said, the weight is the best test of progress. If some of the characteristics of a healthy child are absent—if, for example, it cries frequently, or seems to have colic, or is constipated, and yet week by week it gains in weight, provided the flesh feels firm—there is no cause for anxiety about the nature of the food it is getting, although attention should be paid to the quantity of the food, and to the régime of careful upbringing. Occasionally children fed on food deficient in milk constituents become fat, soft and bloated. This condition should not be mistaken for that of health.

It is, indeed, a cardinal rule of infant-feeding not to change the nature of the food, unless there is definite evidence that the child is losing, or not gaining weight. Every change in diet involves the risk of a few days' digestive disturbance, whilst the child is getting accustomed to the new food. If it is not gaining weight, it must be classed as unhealthy, and most probably will have other signs of ill-health.

Examination of unhealthy children. When a physical examination is necessary the nurse should undress the child completely, before a fire. It is difficult enough in many cases to find exactly what is wrong, but it is still more

difficult if the clothes are only opened, or pulled up to permit of partial examination.

With warm hands, feel the limbs, and look for signs of syphilis, such as tenderness of the epiphyseal lines, pemphigus on the palms and soles. Phimosis will sometimes make a baby cry for long periods after urinating, and also predisposes to hernia and rickets. Notice the child's buttocks and see if they are red. *Red buttocks* are a common accompaniment of diarrhoea. Examine the *groins* to see that the skin is soft and not excoriated, also the *inside of the thighs*, which may be excoriated by napkins which are too bulky, or allowed to remain on when wet. Then examine the *abdomen*. It is prominent in a baby. So too with the *chest*. Notice whether its conformation is regular, whether the breathing is very rapid, if there is any sucking in of the lower ribs with inspiration, and in older children any signs of beaded ribs, the "rickety rosary." Listen over the *lungs* with a stethoscope, and examine the *heart*. Inspect the hands and the feet for pemphigus. Then pass on to examine the head, and above all feel the *anterior fontanelle*, whether it is flush with the bone as in health, or sunk as in ill-health, or bulged as in meningitis. The sinking in of the anterior fontanelle is *a most reliable sign* of ill-health in an infant. Feel the forehead to see if it is moist. Moisture of the forehead means that the child is too hot, or that it is rickety. Take the temperature rectally. This is the most constant and accurate method. Notice if there is any sign of snuffles or cold in the head. Percussion should follow, and remember that absolute dullness will not be obtained even if the pleural cavity is full of fluid. Only a relative diminution of resonance will be found. Examine the mouth. Look for tongue-tie, and for cleft palate. See if there is any thrush, and lastly press down the tongue with your little finger or with the handle of a teaspoon to see the throat. This will make the child cry, and should be left until the last.

Importance of examination. We insist that a systematic examination of the child will save blunders. As an example of the danger of omitting a physical examination may be mentioned the case of a baby that wasted. Various

changes of diet and different medicines were tried without avail. Eventually the child was stripped and a large abdominal sarcoma was found. Or, to give a more homely illustration, we remember being called to stop a long screaming fit, and on undressing the child we found that the binder had been sewn through the skin.

Further investigation. Attention should be directed to the *condition of the napkins,* which should be kept for examination. The nature of the *stools* is of great importance. A normal stool is pale yellow in colour unless starch is given, when it is brownish, of a consistency sufficient to form a mound when passed into a receptacle, and homogeneous. There should be practically no smell. In ill-health the stools may be green, contain curds, undigested fat, slime, mucus, and sometimes blood; or, on the other hand, they may be hard and dry.

Notice whether the *urine stains the napkin.* If it does it means that the child is not getting enough water.

Next pay attention to the *food.* If breast-fed, look for sore nipples in the mother, and inquire as to the care and cleansing of the breasts, the number and times of the feeds, and notice how she suckles. If bottle-fed, ask how often it is fed, and how the food is prepared. Look at the bottles and the teats. Ask how the milk is prepared, and how the bottles are kept clean.

Then inquire into the general hygiene, the appetite, clothing, sleep, fresh air, and how often the bowels move.

Ask whether the child cries much, and, as we advised in the introductory remarks, pay careful attention to the fears and opinions expressed by the mother and nurse who are constantly watching it.

Value of the knowledge gained. Some sound notion should now have been gained as to the cause of ill-health. In the majority of cases there is some mismanagement. Ill-health in a child of healthy parentage is almost certainly due to some error of management, more rarely to some congenital or acquired disease. If an error of management is discovered lay down precise rules for future guidance; it is essential that a young obstetrician should have these at his command, for nowadays many mothers study the

question of baby-management in small handbooks, and can easily expose his ignorance.

REASONS FOR ILL-HEALTH, AND TREATMENT

A.—**Reasons connected with the Feeding.**

1. The food may be too strong.
2. It may be too weak.
3. It may be unsuitably given.
4. The child may not be able to suck properly.
5. It may not get enough fluid.
6. The food may be unsuitable.
7. Accompanying these there may be colic, vomiting, diarrhoea, or constipation.

B.—**Other Reasons.**

8. The child may be kept too hot, in stuffy rooms, and not allowed to have sufficient fresh air and exercise.
9. It may have some general disease.

1. **When the food is too strong.** A child may fail to increase in weight because its food is too strong. This may arise in breast-feeding, but it is much more common in the bottle-fed. It will often vomit after each meal, vomiting the contents of its stomach, and not merely posseting the extra quantity it does not require. It will also probably have constipation, or diarrhoea with colic, as evidenced by screaming, drawing up its legs and hardening its abdomen.

The stools give the most definite signs. If the food is too strong to be properly digested, undigested curd and fat will be found. Either there are separate masses; or else these coalesce so as to make a stool that is somewhat white in colour. These signs occur almost exclusively in bottle-fed infants, and must be watched for with especial care when bottle-feeding is started.

We must here repeat that when an infant is fed on whole milk, whitish stools are not infrequent. Yet it thrives and puts on weight. Therefore this cannot be considered abnormal.

What to do. In all probability the fault lies in excessive fat from a milk mixture which is too strong. The motions are too white, and are either hard and dry or greasy. There

are several alternative treatments, but the main essential is dilution of the milk mixture.

Allow the milk to set for two hours, then strain off the fat and give skimmed milk. Substitute lime-water for barley-water, because lime-water is more likely to aid digestion by diminishing the amount of curd formed. Try feeding every three and a half or four hours, if fed every three hours. By this means the muscular coat of the stomach is rested, and the mucous membrane is cleansed with free hydrochloric acid.

If these measures fail and the child is still in ill-health, the food is unsuitable. Give the diluted milk a fair trial of three days or a week. There is not always immediate improvement with a diet that may eventually prove suitable.

2. **The food may be too weak.** This is a less likely reason for ill-health in bottle-fed children. Breast-fed children may find the mother's milk too weak in a particular ingredient, as, for instance, fat. Draw off milk and send it to be analysed.

There is not a proper gain in weight. The child cries and whines with hunger. When the food is finished, it does not fall contentedly to sleep, but may continue to whine, and is wakeful. It will be constipated. Frequently the signs of insufficient fluid are present, namely, a urine that stains the napkin, and hard, dry stools.

If the child is breast-fed, take test feeds and determine whether the baby is getting sufficient food. If not, give supplemental feeds alternately, advising the mother to rest at those times baby has a bottle. Another simple method is to give one, two, or three teaspoonfuls of pure cow's milk without the addition of sugar or water after it has partaken of all which can be extracted from the one breast. This cow's milk can easily be sterilised by placing it in an iron spoon and heating it over the flame of a spirit lamp till it boils. The plan is greatly preferable to supplementing the breast-food with patent foods given by means of a bottle. The living milk of the mother will add ferments to the dead cow's milk and revivify it. Pay attention also to the health and diet of the mother. Mixed feeding is often very successful.

If bottle-fed, assuming that the baby is not vomiting, and

that its stools are normal, yet not gaining in weight, then increase its feeds. Do this gradually.

3. **The food may be unsuitably given.** Irregularity in the times of feeding is an exceedingly common, perhaps the commonest, cause of interference with a baby's proper progress. Some mothers put the infant to the breast whenever it cries. The food stops the crying for a time. Later it cries again, and is fed again. It may not be put to rest after its meals, but is taken to see some friends or relatives, and as likely as not is jigged up and down by them.

We have already insisted on the importance of cleanliness in the method of feeding. One cannot impress this too emphatically upon the nurse or mother.

Lastly, the food may be given too fast. Greedy children often posset the milk after a meal.

What to do. Insist upon regularity of meals, and upon rest after meals. Put the child to rest either in its cot or perambulator.

Always see that the mother, or nurse, pays strict attention to cleanliness in the giving of food.

If the child is very greedy and gulps down its food as fast as it can, tell the mother to squeeze the nipple a little, to prevent a too rapid flow of milk. In both breast-fed and bottle-fed children the speed of a meal can easily be regulated by taking the baby from the breast or bottle, and making it rest for a minute or two. In addition, if the baby be patted gently on the back, it will aid in getting up the wind and in preventing vomiting.

4. **The child may not be able to suck properly.** Causes: (1) depressed nipples, (2) the jamming of the nose against the breast, (3) bad hare-lip, (4) cleft palate, (5) tongue-tie, (6) prematurity, (7) too small a hole in the rubber teat.

True tongue-tie is very uncommon, but it does occur. It is easily cured by nicking the fraenum with scissors, which is without danger to the lingual artery. The scissors should be blunt-pointed and kept close to the floor of the mouth. The baby should be put to the breast immediately, for the act of sucking stops any oozing. The attendant should not leave until all bleeding has stopped.

Hare-lip and cleft palate. Some surgeons advise operation in the first month of infant life for both these defects, so as to avoid the inefficient nutrition that results from the awkward process of spoon-feeding.

5. **There may not be enough fluid given.** If there is constipation, with dry, hard stools, and the urine stains the napkin, the child is not getting enough fluid. It cries with thirst, and its crying is stopped if water is given to it.

What to do. Give as many teaspoonfuls of boiled water between meals as it will take. This is especially necessary when feeding with whole milk.

Give unsweetened water from a spoon and never out of a bottle. The latter induces the child to take more than is necessary.

6. **The food may be unsuitable.** If there is little or no increase in weight in spite of the fact that careful attention has been paid to the cleanliness, amount, and regularity of meals, the food is unsuitable and should be changed.

What to do. These children have to be treated on much the same principles as malnutrition or dyspepsia in an adult, that is to say, attempt to find out what is unsuitable in the diet, and endeavour to find a diet that is suitable. Again we think it is a mistake to regard babies in too general a light. They, like adults, have their individual likes and dislikes. The aphorism that what is one man's food is another man's poison can be applied to babies. For example, we are perpetually warned in text-books of the danger of giving starch to infants under three months old, and are given as a reason that an infant possesses no amylolytic ferments. Yet we have been guilty many times of disregarding the dogmas of physiology, and have added to the diet of ill-nourished children of under a month old Mellin's, Benger's, or Frame Food, and they have done very well. Even should they fail to digest unconverted starch, we do not see that any great evil need necessarily result, for they can pass the extra food in the stools, just as many adults do who over-eat themselves. We are not, however, advocating any indiscriminate use of patent foods, but are protesting that experience shows that a greater licence can

often be permitted to the digestion than is theoretically allowed to it by the rigid laws of chemical analysis and physiological experiments.

We are now dealing with a child that is not progressing, that has perhaps some signs of digestive disturbance, but these signs are not urgent enough to call for immediate and radical treatment. In short, we are dealing with one in whom we are not satisfied, but about whom we are not really anxious.

Constituents of the diet over which we have control. We have control over the diluent, the fat, the sugar, and the casein.

The diluent. If the milk is diluted it is possible that the diluent itself is at fault. If children fed on barley-water are permitted to become constipated, they will certainly suffer from colic and flatulent dyspepsia due to fermentation of food.

Lime-water may be used if any signs of gastritis, such as vomiting, arise. Lime-water is antacid and is a sedative to the stomach. It also interferes with the formation of rennin curd, which is, therefore, diminished in amount and rendered easier of digestion. In place of lime-water, plain water may be used, with a grain of sodium bicarbonate as an antacid to each ounce of food. This does not interfere with the amount of curd formed, but, by combining with the excess of hydrochloric acid, makes the milk clot more digestible. Citrate of soda is a natural constituent of the mother's milk, and is not found in cow's milk. In 3 to 5 gr. doses it often exercises a favourable influence on digestion. Rice-water is serviceable when there is any tendency to looseness of the bowels, oatmeal-water when there is constipation. Oatmeal-water is made by boiling a teaspoonful of rice in a pint of water for ten minutes, and straining. Finally, plain water is often the best diluent of all.

The fat. Too much fat or too little fat may be given.

Too much fat. This is indicated by loss of appetite and slimy stools containing whitish smears of undigested fat, or the child will pass a motion after each feed, and posset up a teaspoonful or more after each feed.

Cream from cow's milk does not always agree with infants,

probably because it contains less fat of low melting temperature than human milk. In such a case give less fat (it may often be wise to decrease the sugar as well). It is easy to decrease the amount of fat in the milk mixture by discontinuing the cream. If this is not sufficient, it is quite easy to reduce the fat further, either by using a separator, or by letting fresh milk stand in a cool place and skimming off the cream. The amount of fat as cream that can be skimmed off depends on the number of hours the milk is allowed to stand. To obtain approximately 1 per cent. fat, allow 1 pint of cow's milk to stand for four hours and skim off the top 12 oz. The bottom milk contains 1 per cent. fat.

To obtain 2 per cent. fat, allow 1 pint of cow's milk to stand for four hours, and skim off the top 8 oz. The bottom milk contains 2 per cent. fat. The curd produced by clotting entangles most of the fat, so that whey contains much less fat than milk. Whey, in fact, contains 0·5 per cent. of fat at the most, whereas cow's milk contains 3·5 to 4·5 per cent. If, then, the baby seems to lose its appetite, is sick, or regurgitates its food between meals, and has slimy, sometimes very offensive stools, reduce the fat, by stopping the addition of cream, then by separating the cream from the milk by a separator, and lastly, if the signs of indigestion continue, by resorting to whey. Pancreatic emulsion is sometimes tolerated better than cream.

Too little fat may be the reason why a child does not flourish. If there is little or no increase in weight and there are no signs of indigestion, it is likely that an increase of fat will prove beneficial. Therefore, add cream to its diet, or cod-liver oil. Begin with half a teaspoonful of cream or five drops of cod-liver oil to each meal. Even a breast-fed baby may be the better for ten drops of cod-liver oil three times a day after a meal.

Sugar. There may be too much or too little sugar in the diet.

Too much sugar, like too much fat, gives rise to signs of indigestion. Vomiting may be constant. Flatulence, with or without colic, is another sign, and flatulence is especially apt to occur with constipation. The sugar is shut back in the bowel and fermentation takes place. Cane

sugar is more liable to fermentation than milk sugar, but food rarely ferments if constipation is avoided. To overcome these symptoms reduce the amount of sugar, or stop adding it to the mixture. It may be mentioned here that Nestlé's milk, with which we deal later, upsets children sometimes because of the excess of cane-sugar.

Too little sugar is sometimes a cause of non-progress. Try the addition of a little extra sugar to the food if the child, though otherwise well, is not gaining in weight as it should.

Casein. Casein is converted by rennin into calcium paracasein. This is a soft, flocculent curd which, in the absence of hydrochloric acid, is passed into the intestines and is there digested.

Acid is not found in the infant stomach until the third day.

Calcium paracasein is changed into free paracasein by the action of either hydrochloric or lactic acid. This is a tougher curd, and requires pepsin and stomach peristalsis for its digestion. Excess of either of these acids causes continued change with the formation of a very tough, indigestible curd, paracasein hydrochloride or lactate.

Hydrochloric acid combines readily with casein, and is not found free in the stomach until towards the end of digestion. Then it probably acts as a disinfectant and prepares the stomach for a new meal. Therefore it is easy to understand the harm done by giving fresh food before the previous meal has been digested. Casein is the constituent of cow's milk that is the most troublesome for the digestion. We have seen how at first we diluted the milk because of the casein, and how we added lime-water or barley-water and citrate of soda to make the curd more like the curd of human milk; in fact, the modifications of cow's milk are really modifications directed to make the casein more digestible. Yet in spite of all these modifications, the indigestibility of the curd of cow's milk is still the great obstacle to success in the artificial feeding of infants.

We have already dealt with the question of too little casein under the heading of the food being too weak. Fear of the indigestibility of casein has led some doctors to

dilute the milk to such an extent that there remains very little nourishment in it. We, on the other hand, start with the same percentage of casein as is in human milk. At a month old, we go one step further and give undiluted milk. We have found this bolder policy much better than treating the child as if it were an invalid from the time of birth, and could not be expected to digest anything stronger than milk diluted with three or four times its bulk of water. In fact, we believe this timid policy defeats its own end by weakening the power of the gastric and intestinal juices as much as the milk they have to digest. Still, although the stronger foods certainly seem to be advisable, there are children who fail to digest casein properly, and suffer in health from this disability.

Casein indigestion is shown chiefly by colic, and curds in the whitish bulky stools. When the child has colic, it screams with sudden pain, draws its legs up, and hardens its abdomen. Vomiting is more often due to failure to digest fat or sugar. Colic is not uncommon in children, and when accompanied by progressive increase in weight is not of serious importance. But when there is colic with curds in the stools, and perhaps diarrhoea and unsatisfactory progress, the quantity of casein given to the bottle-fed child must be modified. If we are not sure which of the food ingredients is the cause of indigestion, we are more likely to get good results by first altering the casein.

To alter the casein. The simplest way is to increase the amount of diluent.

There are six other means of altering the casein :

(*a*) By some form of whey and milk mixture.
(*b*) By giving condensed milk.
(*c*) By giving peptonised milk.
(*d*) By the use of patent foods.
(*e*) By the use of citrate of soda.
(*f*) By the use of protein milk (see p. 657).

(*a*) **Whey mixtures or milk and whey mixtures.** One of these has already been given (see p. 657). Whey contains less than 1 per cent. of protein, and therefore this is a very efficient method of decreasing the casein.

The amount of fat is also reduced to about one-fourth, but the sugar and salts, being in solution, are not altered.

To make whey, add one and a half teaspoonfuls of extract of rennet to a pint of fresh milk. Stand it in a warm place until it curdles firmly. Break up the curd with a fork, and strain it through coarse muslin. The whey mixture has the following constituents :

Whey	$1\frac{1}{2}$ oz.
Gravity cream (15 per cent.) . .	1 oz.
Lime-water	$\frac{1}{2}$ oz.
Solution of sugar of milk . .	$1\frac{1}{2}$ oz.
Citrate of soda	3 gr.[1]

This mixture is like the milk mixture, except that it has one-half to one-third less protein. Manage with it as with the milk mixture, and if there are signs of too much fat or sugar, decrease them as in the milk mixture. As the child improves, gradually substitute milk for whey.

(*b*) **Condensed milk.** While we do not approve of condensed milk, it must sometimes be used for want of something better. There are two varieties, sweetened and unsweetened.

The caloric value of unsweetened milk is 60 calories per oz. It contains :

Protein	8·3 per cent.
Fat	12·4 ,,
Lactose	16·0 ,,
Ash	2·0 ,,

If this is diluted four times, *i.e.* one part milk to three of water, and 3 per cent. sugar is added, it approximates human milk. We believe that condensed milk is deficient in vitamins, and if used, cod-liver oil 5 drops, three times daily, should be added.

(*c*) **Peptonised milk.** Where whey mixtures fail, peptonised milk will sometimes succeed in nourishing a child, but we prefer to try whey mixtures thoroughly first. Peptonise milk by means of Fairchild's powder. Stir, and keep the mixture for twenty minutes at a temperature

[1] Soluble albumin in the form of Albulactin is a useful addition to all varieties of artificial foods.

of 110° F. Then raise quickly to boiling-point to stop the action of the ferment, and cool. Dilute with one, two, or three parts of water, and add a little cream and sugar, because an infant that must be fed on peptonised milk has little healthy digestive power. Gradually, as it improves, decrease the time the powder is allowed to act, and increase the amount of fat and sugar, until the mixture returns to the composition of the milk mixture, or some other mixture with fresh milk that suits. Pepsencia is a simple, more palatable, and probably a more efficient pepsin than the above.

The use of patent foods and citrate of soda.

(*d*) **Patent foods.** It is difficult to lay down any rules for patent foods, but when there is no increase in weight, the addition of some infant food to the bottle will often cause improvement. Many patent foods can be added to milk, or, when the casein is badly digested, they can be made up with whey, or can be made with water only. The directions are given on the packages.

Some children who are unable to digest ordinary milk thrive on Allenburys' No. 1. This is a dried milk, and is prepared for use by the addition of water. This food often becomes musty in the tins, and unless it has a pleasant biscuit-like smell it should not be used. Mellin's, a malted food almost free from starch, with whey as a diluent, makes a good food in some cases, when milk is not tolerated as a diluent, but its use should not thus be continued for over one week. Savory and Moore's, and Benger's Foods we have also found of real use in quite young infants who were going backwards or were stationary on other foods. The use of any of these foods should be a temporary expedient, and they are not to be preferred to a milk diet.

Frame Food may be used as an addition to the milk of children over six months old. A child at this age has been drinking pure milk. We blend a teaspoonful of the food in some milk and boil for five minutes. We then add the rest of the milk for the meal, and in this way the pure milk is not diluted with water.

Other foods we have found useful are Cow and Gate, Alenata, Sister Laura's food, Trufood.

As most patent foods are deficient in vitamins, some fruit or vegetable juice should always be given. Orange juice, prune juice, or turnip juice may be used. Scurvy has developed in children fed exclusively on dried milk. Some authorities believe it better to order only food without starch in the first six months, but we have seen no definite ill effects from starchy foods.

The suggested ill effects from starch are distension, diarrhoea, constipation, flatulence, and are said to be due to fermentative action of starches.

It is quite impossible to make any dogmatic statement, it is only possible to suggest a skeleton form of feeding. As a general rule, before giving any food, study the various percentages of the three main physiological factors, protein, fat, and carbohydrates, and try to make them conform to breast-milk standard.

(*e*) **Citrate of soda.** If digestion is not satisfactory, it is wise to add citrate of soda in the proportion of 1 grain to every 2 oz. of the food. This produces a soft curd which is more easily digested. Soluble salts of calcium are necessary to enable rennet to cause coagulation of milk. It has been suggested that sodium citrate combines with these calcium salts and limits or stops the ferment action, according to the dose.

Summary changes of diet for a child that does not progress in weight. Find out whether the food is too strong or too weak; whether it is suitably and cleanly given; whether the child is able to suck properly and has enough fluid, and treat it accordingly. Then pay attention to the diluent. If the food upsets the digestion, find out whether fat, sugar, or casein is at fault. If alteration of the constituents of milk mixtures with the dilution does not enable it to digest properly, resort to whey mixtures; or in place of whey mixtures, for a child of poor parents, use the condensed milk. If whey mixtures fail, try dilute peptonized milk. If still dissatisfied, try either the addition of some patent food to dilute milk or whey, or in bad cases try a patent food such as Benger's, Allenburys' No. 1, or Glaxo [1] alone, for a time. Give grey powder in these cases. Always

[1] Glaxo is a dried and powdered milk.

examine the baby carefully to discover the other conditions of its life, and, finally, remember that an infant takes a little time to get accustomed to a change of diet, and do not hastily abandon a new diet because the child does not show signs of immediate improvement. Very rarely a child will not thrive with any of these methods. A wet nurse should then be procured if possible. It is very probable that human milk contains some substances which are capable of increasing the complement in the infant's blood, thus enabling the antibodies to combine with the food.

7. **Colic, vomiting, diarrhoea, constipation.** These conditions are nearly always due to errors of diet, and the nature and correction of these errors have already been discussed.

Colic. Treatment. When it is due to intestinal flatulence, no drugs are of much avail. Glycerine, minims 30, in 2 oz. of cold water injected high up into the rectum, is the best treatment.

Vomiting. Treatment. Treat the cause. Vomiting may be acute or habitual.

Acute vomiting. (*a*) Acute indigestion.
(*b*) Acute infectious gastro-enteritis.
(*c*) Miscellaneous—infectious diseases, obstruction, nephritis, cerebral, drugs.

Habitual. (*a*) Errors in administration.
(*b*) Over-feeding.
(*c*) The hypertonic child.
(*d*) Organic—pyloric spasm or stenosis, dilatation, reflex vomiting.

Many mothers believe the child to be vomiting when it is only posseting.

Treatments :—(*a*) The food is commonly given too quickly. It is well to break the feed several times to get the wind up.

(*b*) Stop food. Give water and sodium bicarbonate. Empty bowel. Wash out stomach. Give sedatives.

(*c*) The hypertonic child is thin, has blue extremities, is constipated, always restless, and has symptoms simulating closely pyloric stenosis. Feed this child very slowly, keep

very warm, and give atropine 1 gr., water 2 oz., one to three drops in each bottle. The child also suffers from insomnia.

(*d*) Pyloric stenosis is commonest in the male child. Symptoms :—When the child is four to five weeks old, at one feed it vomits in a projectile manner : the vomit may be blood-stained. At this stage it commences to be constipated. The vomiting immediately after a feed increases day by day. On examination of the child's abdomen during a feed, peristaltic waves will be observed passing from left to right. A tumour may be felt at the commencement of feeding, to the right and just above the umbilicus, which rises up towards the gall bladder at the end of the feed. If the child is in good condition, operation is the best treatment and should not be delayed.

Treatment of dilatation :—Wash out the stomach and reduce the quantity of feeds.

Rumination. This is a rare complaint, and difficult to treat. Shortly after the child has finished its bottle, it proceeds, by projecting its chin and working the muscles of its neck, to bring up into its mouth some of the food of which it has just partaken : some of this is swallowed, and more spilt over the pillow. A queer look of ecstasy comes over the child's face.

Treatment. Strapping the jaw has been tried with only moderate success ; giving thicker foods is also tried, but we think the only course is for the nurse to sit by the child after its feed, and when she sees it push forward its chin, to push it back at once.

Diarrhoea. Looseness of the bowels can usually be stopped by decreasing the amount of food for a few meals and giving a dose of castor oil. Then endeavour to discover the ingredient at fault, and lessen or remove it. When starting milk again after resting the bowel, protein milk without the whey is an excellent diet. As the condition improves, again start adding the whey by degrees.

Infective enteritis or green stools. Diarrhoea of a more definite nature nearly always results in *green stools*, and frequently the buttocks are excoriated and red. Vomiting may accompany the diarrhoea. It is because of the

association of these two—red buttocks and green stools—that the napkins and buttocks of the child should always be carefully examined. Thrush often accompanies the diarrhoea also.

Treatment. Treatment is first directed to the cause, and this will frequently be found to be cracked nipples in a breast-fed baby, or a dirty bottle in a bottle-fed child. Treat the cracked nipple, or insist on greater care in the preparation of the food.

First, give a teaspoonful of castor oil. If the child vomits wait for two hours and give another teaspoonful. Ten to twenty drops of syrup of rhubarb can be given instead of castor oil. In more severe cases, wash out the bowel with a soft No. 10 catheter and two or three ounces of water. *Washing out the bowel and stomach is the essential treatment of food poisoning.* Do not hold the funnel more than 1½ to 2 feet from the baby. The intestines are cleansed of their decomposing or irritating contents in this way (see p. 184, Infantile Convulsions). Keep the baby from the breast for twenty-four to forty-eight hours, and give it hot water or albumin water (white of one egg to a pint of cold water). If bottle-fed, do not give it cow's milk for two or three days. Hot water and albumin water suffice. Beef juice (made by taking a pound of raw beef, mincing it, soaking it in one pint of cold water, and straining the product through muslin) contains the soluble albumin of meat, and is therefore nutritive. The real difficulty in treatment comes when milk has to be given again. The digestive organs have been upset, and proper treatment consists of a judicious balance between resting the digestive organs and using them for nutrition.

In breast-feeding, begin by short feeds at four-hourly intervals, and then at two-hourly intervals, giving plenty of water between meals. Give abundant fresh air and sunlight.

In bottle-feeding, begin after twenty-four or forty-eight hours with pepsencia whey, gradually adding sugar and fat, or give dilute peptonised milk. These cases are suitable ones for feeding temporarily with a patent food.

The best drug with which to control any diarrhoea that

persists after disappearance of the green colour is bismuth. Give the salicylate of bismuth in five-grain doses with four grains of aromatic powder of chalk, three times a day, to a child of six months. Give a fourth of the above doses to a child of a month, and a half to one of three months.

Grey powder in half-grain dose, twice daily, may be given as a routine in these cases.

A modern treatment is the administration of weak China tea.

Red buttocks are best treated by keeping the baby out of water. Wash them with milk, and smear zinc ointment thickly over them.

Aphthous stomatitis, or thrush. Thrush is a disease of the mouth that results from a dirty nipple or bottle, or the much-treasured, but frequently filthy, comforter, the use of which we strongly condemn. The tongue and cheeks are covered with white patches which cannot be wiped off. The mouth is dry. Thrush is due to a mould, and can be cured by painting the mouth and tongue thoroughly all over twice daily with 1 per cent. aqueous solution of gentian violet. The treatment should be continued after all signs and symptoms have disappeared.

Constipation. Treatment. Constipation is common in breast-fed children, and more common still in bottle-fed children in spite of the casein in cow's milk. Early education is of vital importance.

Causes of constipation :

(*a*) Gastric indigestion.
(*b*) Too much fat.
(*c*) Too much sugar.
(*d*) Too little sugar.
(*e*) Too weak a food.
(*f*) Too concentrated a food.
(*g*) Vomiting.
(*h*) Boiled milk.
(*l*) Cathartics.
(*j*) Habit.
(*k*) Organic—fissure of the anus.
(*l*) Haemorrhoids.

Treatment. Study the cause. Foods which exercise excessive laxative action are inclined further to upset the digestion. In breast-fed infants it is occasionally due to poor milk. Try to increase protein by giving the mother eggs, ash and meat. Some malted food is often helpful —Mellin's or Horlick's Malted Food, or simply the liquid extract of malt added to milk.

Be very careful about adding cream, as harmful results

often develop through a milk mixture containing more than 3·5 per cent. fat.

Massage is a great help. When giving drugs, do not order "to be given when required," but "to be given regularly."

For mild cases, manna, a piece about the size of a hazel nut, in three feeds. Hyd. $\bar{c}$ creta $\frac{1}{2}$ gr., sod. bicarb. 2 grs., pulv. rhei 2 grs., twice daily to a child three to four months old.

Do not get into the habit of giving enemata.

8. **The child may be kept too hot, in stuffy rooms, and not allowed enough fresh air and exercise.** We have already dealt with these points, and only repeat them here to emphasise their importance.

9. **General diseases. Marasmus.** By marasmus we mean those infants who either lose weight or fail to gain it. Marasmus is really a symptom rather than a disease, and is caused by many different things.

1. Unsuitable food.
2. Insufficient dilution of milk.
3. Excessive fats, sugar or starch.
4. Insufficient fat and protein, such as caused by condensed milks or over-dilution of cow's milk.
5. Too large feeds for age of child.
6. Idiosyncrasies to either fat, protein, or carbohydrate.
7. Some disease in the child, *e.g.* syphilis, heart disease, tuberculosis, nephritis, pyelitis.
8. Constipation.

As will be seen, most causes are dietary, and we think the greatest number of marasmic cases are made, not born.

Treatment. There are some children who apparently thrive on anything, and live and even thrive on gross theoretical errors, but sooner or later the wisdom of adhering to nature will prove its value, and the converse is true. We think more harm is derived through over-strong milk mixtures than dilutions.

Accordingly, study the case and see if possible from past history in which respect an error of diet has been made.

Re-educate the bowel—for a few days it is often helpful to give a weak broth, followed by well-diluted milk. Patent foods will sometimes succeed where cow's milk fails. We

advise those foods poor in fat, *e.g.* Cow and Gate half cream. Again, an over-ripe banana passed through a sieve, a small portion given daily to a child, has proved successful. For a child three months old, a quarter banana twice daily given with care.

Blood transfusion with glucose may give that necessary stimulus which is needed to help the child over a difficult period.

An easy method of estimating the quantity and amount of mixture is as follows :—Take 3 c.c. of 1·5 per cent. citrate of soda solution. Add 12 c.c. of blood. The mixture of 15 c.c. is then 0·3 per cent. of citrate blood. For a month-old child add 5 to 10 c.c. of a 10 per cent. solution of glucose; the temperature being 99·5° F.

Congenital syphilis. Congenital syphilis may show itself at or shortly after birth. Such children are wizened and have the "old man" aspect. Eruptions break out on the body, the most typical being the bullous eruption, which appears especially on the soles and feet, and is known as syphilitic pemphigus. They usually die within a week or two of birth.

More frequently the child is in excellent health until it is a month old. Snuffles, a macular rash which tends to become the well-known raw-ham colour, the syphilitic psoriasis of the soles and palms, fissures around the mouth, acute inflammation, with extreme tenderness of the epiphyses of the long-bones, and malformation of the nails, are the principal signs of syphilis in the early months of childhood.

If it be desired to obtain the infant's blood for Wassermann reaction, this can be done through the anterior fontanelle. Injections of N.A.B. are best given to it through the external jugular vein, the dose being 0·05 gramme.

It is wise to combine mercurial inunctions daily with other treatment. We rub into the child 1 gramme of a mercurial cream daily, over one part each day—1, chest; 2, back; 3, abdomen; 4, buttocks; 5, legs; 6, arms. We also suggest hydrarg. iodidum flavum $\frac{1}{6}$ gr. daily.

Foetal circulation and congenital heart disease. In the foetus with functionless lungs the circulation is materially different from that of the breathing baby.

The blood from the left ventricle is pumped into the aorta, from which it proceeds to the head and neck, body and limbs. A strong stream of blood passes along the two hypogastric arteries, which spring from the internal iliacs into the umbilical cord. The umbilical arteries furnish the placenta with foetal venous blood. The blood, oxygenated, returns by the umbilical vein, which, after entering the abdomen, divides into two branches, one of which joins the portal vein, whilst the larger enters the inferior vena cava by the ductus venosus. The blood of the inferior vena cava discharges into the right auricle, and most of it then passes into the left auricle by means of the foramen ovale. From the left auricle it goes into the left ventricle. The blood in the superior vena cava, returning from the head and neck, passes into the right auricle. Some of the blood in the right auricle passes into the right ventricle. By the contraction of the right ventricle this blood is forced, some into the lungs through the pulmonary arteries, but most passes by the ductus arteriosus into the aorta, joining the stream from the left ventricle.

The practical importance of understanding the foetal circulation is that the foramen ovale and ductus arteriosus, which should close soon after birth, sometimes remain patent. When they do, the result is a form of congenital heart disease. The child is feeble, blue and cold. It is liable to convulsions and attacks of vomiting. Loud systolic bruits are often heard. The management consists in wrapping the child up in cotton wool, and guarding it with especial care, but the results are disappointing, as children with congenital heart-disease are always ailing, and rarely live to maturity.

It is important to remember that many congenital heart cases do not have blueness of the face, hence the importance of making a thorough examination of every case.

Congenital stenosis of the pylorus. This is to be remembered when dealing with a baby that frequently vomits (see p. 673).

Rickets and scurvy. These diseases may show themselves in children of six months or under, either as the result of bad feeding or of chronic gastro-enteritis.

The above diseases are those most likely to affect the progress of the child, by an interference with its health, not so sudden in itself as immediately to call attention to the disease.

Anaemia. Anaemia is common in city children, and is often overlooked as a cause of ill-health. It is readily cured by compound syrup of the phosphate of iron, ten to twenty drops, three times a day.

BIRTH INJURIES

Depressed fracture of the skull and facial paralysis. These have been described under injuries from forceps.

Fractures and dislocations. Fractures of the limbs or clavicles sometimes occur as the result of difficult births. The arm may be broken when bringing it down in a difficult breech delivery, the leg in an impacted breech. In treating these cases, the fracture should be reduced, and the arm bandaged to the chest, and the forearm immobilised by flexing it and enclosing it in the chest bandage. The thigh and leg should be flexed up along the body, and bandaged there. Dislocations should be reduced, and the affected joints immobilised. The bandages should be removed early and careful massage and passive motion carried out.

Brachial paralysis. Paralysis of the arm is a rare sequel to a difficult labour. Unlike facial paralysis, it frequently remains permanent. On account of this difference Küstner carefully investigated these cases, and came to the conclusion that there had always been some fracture or dislocation of the humerus at the same time. The cases of birth palsy known as "Erb's Paralysis," characterised by wasting of the deltoid and pectoral muscles and brachio-radialis, belong to a different category. Here the lesion would appear to be rupture in the brachial plexus; the symptoms of pronation of the forearm with inability to raise the arm are sufficiently characteristic, and in these cases the treatment of permanent paralysis ought to be surgical, freeing the nerves, and if necessary reuniting them. The position of the baby's hand has been described as that of a "waiter about to receive a tip."

Cephal-haematoma. A cephal-haematoma is an effu-

sion of blood beneath the periosteum of the skull, which appears on the second or third day. It does not therefore extend beyond a suture. In this way a cephal-haematoma can be diagnosed from a caput succedaneum, the swelling of which is not limited by sutures. It is differentiated from a meningocele by the time of its appearance, as well as its situation, the latter being over a gap in the bones which is readily felt, also by the fact that a meningocele connected with the cavity of the cranium becomes tense when the child cries. Nothing need be done, for the blood is absorbed after some time.

Haematoma of the sternomastoid. This is by no means a rare condition. Many think torticollis may follow a haematoma of the sternomastoid.

Cerebral haemorrhage. Cerebral haemorrhage may result from a difficult labour. This, more commonly than is generally supposed, is a cause of sudden death occurring soon after birth.

Apart from any possible injuries due to forceps, asphyxia may arise from protracted birth: the blood becomes overfilled with CO_2, the vessels are more friable and cerebral embolus may be the outcome. This seems to account for difficult cases with epileptiform fits, with no other history or explanation. Its symptoms depend on the amount of blood poured out. Convulsions may be followed by death. Some of the cortex may be destroyed, causing various birth palsies.

CONGENITAL MALFORMATIONS

With tongue-tie, cleft palate, and hare-lip we have already dealt under interference with the baby's power of sucking.

Meningocele, encephalocele, spina bifida. The immediate treatment of these conditions is to cover the swelling with cotton wool in order to keep them from friction or injury. For further treatment the opinion of an operating surgeon should be sought.

Club-foot. The proper treatment of club-foot is immediate movement. Six or eight times a day the feet should be pulled into the right position by the nurse, beginning from the time of birth. Further treatment is given in works on surgery and orthopaedics.

Phimosis. This should be treated by circumcision. It can be done quite simply without anaesthetic between the eighth and fourteenth days. After this date open ether should be given.

Circumcision. The skin is cleansed with weak solution of biniodide in mercury. All aseptic precautions are taken, but this is the one operation in surgery where gloves need not be worn. The legs are held apart by the nurse; the foreskin is stretched and is then placed at right angles to the penis at the level of the glans, after which the redundant foreskin is removed. Two clip forceps are then placed on the underlying mucous membrane, which is peeled away from the glans penis. There is no need for the insertion of stitches. A piece of iodoform gauze 1 inch wide is wrapped around the top of the penis, and a second on top of this. A sterile piece of gauze is then applied. The first piece of gauze is removed in forty-six hours, the second on the third day. The baby is placed in the bath from the commencement. The legs must be kept close together by the binder.

This method achieves a better conservative result than any other : it is a safe operation and takes about a minute to perform.

Stitches are never necessary unless there is a spouting vessel—a very rare occurrence—and the operation is so quick that an anaesthetic is superfluous. If a stitch is necessary, it unites the skin and mucous membrane.

Umbilical or inguinal hernia. These herniae may be aggravated by straining due to phimosis, in which case circumcision is advisable. For both these types a rubber truss is the best treatment. Alternatively, an umbilical protrusion may usually be cured by folding the skin over the protrusion by means of a strip of plaster or strapping, or keeping a penny or the cork of a pickle bottle over the hernia by strapping.

In some instances the child is born with a large hernial protrusion, in which the intestines can be seen in a thin sac. This sac gives way in a few hours, so that an immediate operation must be undertaken. In the course of the operation we have found the sac so intimately connected with

the bowel, that it was safer to leave parts of it than to risk tearing the bowel in trying to peel it off entirely. We have also experienced great difficulty in returning the hernia. Therefore, we insert all the sutures, leaving them untied, and then push back the intestines and tie the sutures one by one. The treatment of inguinal hernia belongs to general surgery.

Imperforate anus. If there is only a thin partition this can be divided.

When there is no proper anus the operation consists in making a vertical incision with a knife in the middle line where the anus should be. If the bowel is not exposed, the incision must be deepened, cutting as close to the sacrum as possible to avoid the bladder. When the bowel is seen bulging down, open it carefully by puncture. Do not pull the bowel down, but pass the little finger or a bougie daily to prevent the incision closing. Be very careful to stop all haemorrhage after this operation. Infants are apt to die from quite a small loss of blood.

Naevus. Children are not infrequently born with small naevi, which may grow larger, and so it is well to remove them early. This can be done by excision with a sharp knife, by electrolysis, or by carbon dioxide snow.

DISEASES THAT APPEAR SHORTLY AFTER THE BIRTH OF THE CHILD

Congenital syphilis and thrush. These have been described.

Mastitis. The breasts of both male and female sometimes secrete after birth. If the secretion is squeezed from the breasts, a rapid cure will result in most cases. If an abscess forms, open it in the usual way.

Gum or strophulus. Gum consists of little red pimples crowned by a vesicle or yellow crust, which appear when a baby is too hot or has indigestion. For example, they may be seen on a baby's cheek that has been resting against the breast of the mother.

Treatment. Keep the child cooler and use a dusting powder. Attend to its digestion.

Jaundice. Slight jaundice is common about the third

day of infant life. Treatment is not necessary, but two or three grains of phosphate of soda may be given three times a day, and frequent teaspoonfuls of warm water.

More severe and deeper jaundice is due to some congenital or acquired disease of the liver, or stenosis of the bile duct, and ends fatally.

Jaundice may also be a feature of umbilical sepsis, when it is of quite secondary importance.

Sepsis of the umbilical cord (see p. 312).

Haemorrhage from the cord (see p. 312).

Melaena and Haematemesis. The baby may swallow blood at the time of delivery or suck it from a cracked nipple and pass it per rectum. More frequently it vomits such swallowed blood. Duodenal ulcer and intussusception have been found in babies a few days old. True melaena is a condition of great seriousness. It is sometimes associated with subcutaneous haemorrhage and bleeding from the cord, and is frequently fatal.

It is now known to have its most usual origin in duodenal ulcer, a possible resultant of embolism. Horse serum, given in large doses 10 to 20 c.c. by the mouth or hypodermically, has proved almost a specific. Adrenalin solution in three-minim doses and calcium lactate in five-grain doses are valuable remedies; as an alternative to horse serum, 5 c.c. of blood, drawn directly from the mother's vein, can be injected subcutaneously.

Treatment. First examine for cracked nipples.

In the dangerous cases give little or no food until the bleeding has stopped. Give water by the mouth. Calcium lactate gr. iij, with adrenalin chloride one minim every four hours, will prove effectual in many cases. If it seems successful, continue it three times a day until there has been no bleeding for a week.

ECZEMA

Infantile eczema is another disease that must be attributed to food poisoning, as it almost invariably occurs in over-fed or plethoric infants, and is generally influenced by diet. The disease usually arises at or about the period of the first dentition, but it may appear within one month of birth,

and is usually preceded by a roughness or redness of the cheeks described by the nurse as being due to harsh winds.

When severe, eczema may cover the head, face and most of the body, the palms of the hands, and soles of the feet excepted; when occurring in these localities it is usually syphilitic.

The disease is often very chronic in character and may continue into adult life, causing baldness of the scalp, destruction of eyebrows and eyelashes. The older writers warned against attempting a too rapid cure, as it had been found that a sudden disappearance of symptoms might coincide with a fatal outbreak of convulsions.

Prognosis. The disease usually yields to skilful and intensive treatment, and convulsions do not occur as a result of a cure having been achieved, but rather owing to the poisonous elements in the system having been diverted into another channel.

Treatment. A combination of general and local measures is the best. Investigate the food.

The protein in milk usually aggravates, similarly often a high sugar content. It is necessary to continue milk because no other form of food can replace it. To leave off milk, one hovers between the Scylla of eczema and the Charybdis of indigestion, and we consider the digestive functions of prior importance in the growing child. Eczema is a complaint to be borne and gone through with.

Reduce the protein and sugar, and give salt-free food, and apply soothing ointments, such as calamine ʒi, zinc oxide 20 grs., oleum olivae ℥ss, aq. calcis ad ℥iv.

INFANTILE CONVULSIONS

Causes. The nerve centres in infancy and childhood are always in a comparatively unstable condition, and are apt to manifest this instability by convulsive storms. Thus the processes of early dentition, or the onset of the acute infective fevers, such as scarlatina and measles, may be associated with convulsions.

Very young children may develop convulsions as the result of brain lesions inflicted at the time of birth; or they may arise from lesions of which the origin is obscure.

Hereditary syphilis, too, may occasion them, and it is probable that true epilepsy develops at an early period of infancy.

To make an accurate diagnosis of the cause is often a matter of extreme difficulty, and many of the diseases associated with convulsions do not fall within the province of the obstetrician.

A more common cause of convulsions than any of the above is the digestive disturbance of infancy, and to this we desire to call special attention.

Few children brought up by the bottle fail to develop green stools during some portion of the period of bottle-feeding. These green stools are not infrequently connected with convulsions. They occur with diarrhoea, which is sometimes very severe, but are occasionally seen with constipation. They arise, too, as a result of gastric disturbance, or of thrush. This green pigmentation is due to germ invasion, and the stools in which it is found are apt to be very toxic.

We have frequently noted that the occurrence of convulsions has followed misdirected efforts to arrest green diarrhoea. They have also seemed to us to follow excessive abstraction of fluids from the infant's body, in cases where severe vomiting and diarrhoea coexist.

Given a child in convulsions, who at the same time has been suffering for some days from green stools, vomiting, and diarrhoea, with red buttocks and evidence of thrush, with a depressed fontanelle, pale sunken cheeks and eyes, the probability that convulsions have arisen from these associated conditions will be strong, and treatment which does not take this morbid state into consideration will be of no avail.

Treatment. The above diseases have already been fully dealt with, but we would again emphasise the point that castor oil in full doses should be at once administered.

Float a drachm and a half of castor oil on the top of a wineglassful of hot water. From the water it is readily skimmed, and can be easily administered.

All other available methods to effect elimination of toxins should be adopted; these will include enemas of soap and

water, or plain salt and water. From one to two ounces of fluid may with safety be injected into an infant's rectum; a larger quantity is unnecessary and has been known to cause rupture of the bowel. If there be any suspicion that the stomach contains indigestible matter, it should be washed out with saline solution, and through the tube used for this purpose the oil can be conveniently poured. If the child's system requires fluid, this can be given by the mouth, by the rectum, or by subcutaneous saline injections. We have employed all three methods with satisfactory results.

Whilst these remedies are being prepared, the child should be placed in a hot bath to which a teaspoonful of mustard has been added. A handkerchief wrung out in cold water and laid on the head whilst the child is still in the hot bath is a mode of treatment which some have found efficacious.

If the child has already been placed in a hot bath, do not do so again, as worse fits may arise through the irritation it will occasion. Place hot packs about the child, and cold stupes to its head. If actually in a fit, give a few whiffs of chloroform to relieve the spasm, and whilst under the influence of the chloroform, if the bowel has not been washed out, wash out, and follow by high enema of chloral hydrate in water or milk. Chloral hydrate 3 grs. for an infant three months old, rectally, usually has an excellent effect.

Morphia given hypodermically:

Child six months old	gr. $\frac{1}{40}$
Child one year old	gr. $\frac{1}{20}$
Child two years old	gr. $\frac{1}{10}$

Mag. sulph. hypodermically 10 grs. for a child three to four months has been advocated; and lastly, do not forget oxygen, which often succeeds when all else fails.

For prolonged treatment, starvation, plenty of fluids with high sugar, is often good.

OPHTHALMIA NEONATORUM

Infection. The eyes of infants and very young children are apt to become infected and develop acute conjunctivitis. The infection is frequently, but not invariably,

due to gonorrhoea, the germs of which become inoculated during the child's progress through the parturient canal. When infection thus arises, the disease develops on the second or third day after birth.

Ophthalmia sometimes arises from an infection communicated many days after birth. An infection arising as late as the sixth day is seldom of a severe nature and is often confined to one eye.

Danger. An increased knowledge amongst doctors and nurses has happily rendered the disease rare, but it still remains the one affection of all others that swells the ranks of the class of unfortunate beings who are commonly stated to have been "born blind," or who have been "blind from birth." It is now a notifiable disease in some parts of the British Isles. It must also be noted that destruction or injury of the eye may follow treatment carried out on the most approved principles, and the obstetrician should never hesitate when possible to resign the case to the care of a skilled ophthalmologist, who may be depended upon to have at his command a resourcefulness and skill in the treatment of such cases beyond that of the obstetrician. It frequently happens, however, that such skilled help is not available, and for those who find themselves in this position our remarks are applicable.

The prognosis is usually good, if treatment is begun early and executed thoroughly.

Course and symptoms. It is not uncommon to see the disease starting in one eye, but quite the exception to find it remain localised for many days; as a rule both eyes are soon involved.

The conjunctiva becomes red and injected and soon pours out pus. Owing to the swelling of the lids and the spasm of the orbicularis the pus is pent up in the eye. When the eyelids are opened the pus wells out. Sometimes so great is the tension that the pus squirts out. Later, ulcer of the cornea may occur, with the result that the eye is entirely destroyed. Permanent haziness of the cornea may result.

From November 1903 to November 1910, 11,364 women were delivered at full term in the Rotunda Hospital and

eighteen children developed ophthalmia. To this number must be added one which we personally know to have developed the disease after the mother's discharge from the hospital on the eighth day; we have met with other cases where ophthalmia has apparently resulted from a late infection. It is easy to understand how contaminated swabs, rags, towels, or marine sponges could serve as a medium for the conveyance of infection.

Prophylaxis. We find it impossible to doubt that the small number of cases seen has been entirely owing to the fact that Credé's prophylactic treatment, the dropping of a one per cent. silver nitrate solution into the eyes of the infant immediately after birth, has been adopted by us as a routine measure. Where this prophylactic has seemed to fail we believe it to be due to the fact that the solution has never reached the eye. More than once we have noticed nervous probationer nurses failing to get the infant's eyelids properly open while performing this operation, and we suggest the following as a ready method of ensuring success.

Place the infant on the nurse's lap with face looking towards the ceiling, pour a little pool of the solution into the hollow between nose and eye, then whilst this pool is *in situ* let the lower and upper eyelids be pulled apart by the thumbs of the nurse. The inexperienced have expressed fears lest the eye be injured by an excess of the silver solution, but such fears may be dismissed as groundless.

Our prophylaxis, moreover, extends further than this, for we make it a rule to douche out the vagina with a solution of cyllin during the first stage of labour in all women who are found to be suffering from purulent discharges. The infant's eyes are also wiped with clean linen rags or moist cotton wool immediately after birth. Wipe from the outer canthus towards the nose, for in this way the eyes are more likely to be efficiently cleansed.

Treatment.

The sound eye. If the disease develops in one eye, every effort should be made to guard the other from infection. Attention will therefore be directed in the first instance to the sound eye. Place the baby on the side which corre-

sponds to the diseased eye, and wipe the sound eye with pledgets of cotton wool soaked in warm boric lotion in a direction moving towards the nose. Do not use the same pledget twice.

Drop a one per cent. solution of nitrate of silver into the eye, and repeat this process night and morning so long as the infant shows a trace of infective inflammation.

Cover the eye in a very thorough manner with numerous small pledgets of cotton wool soaked in boric lotion. Over this place protective tissue and keep the whole in position by long strips of soap plaster.

The diseased eye. Having by this means secured the sound eye from possible contamination, proceed to treat the inflamed one. Wash it with the boric solution, wiping gently in a direction opposite to that of the sound eye, that is, the direction should be from the nose towards the outer canthus, the infant remaining as before lying on the side of the bad eye. In this way fear of splashing in the direction of the sound eye is avoided. Do not rest satisfied with the wiping of the outside, but open the lids carefully to permit the lotion to gain entrance to the conjunctiva. The conjunctiva is greatly swollen, and the assistance of another person is often needed before the cornea can be seen and irrigated by squeezing the lotion from the wipe. The baby is best held on the lap with its face looking towards the ceiling and body slightly inclined towards the diseased side.

Show the nurse how to bathe and dress the eyes so that she will be able to carry out the treatment. If such bathing can be carried out every hour during the day and every two hours during the night so much the better, and in addition to this a two per cent. solution of nitrate of silver should be dropped in night and morning during the height of the disease, and less frequently, or else a weaker solution substituted, when the inflammation shows signs of abatement.

When the disease is very acute cold wet compresses tend to subdue inflammation, but they should be discontinued when the disease becomes subacute.

The infective nature of the pus is a very great danger.

Warn all concerned of the danger of getting the pus into the eyes. Thus when opening the baby's eyelids keep the face away, else the pus may squirt into the eyes. The hands, after dealing with the child, must be carefully washed, and all wool or linen used must be burned.

INTUSSUSCEPTION

Infants occasionally develop intussusception, although the disease is more common after the sixth month. Straining, passing mucus and blood by rectum, persistent and loud screaming with or without diarrhoea, are the symptoms that suggest its presence. Careful abdominal palpation will reveal a fusiform, or sausage-shaped tumour, usually in the region of the umbilicus. Digital exploration of the rectum at times confirms the diagnosis.

Treatment. Palliative measures have no place in the treatment of intussusception. Immediate abdominal section is the only justifiable procedure.

RICKETS

Rickets is a disease chiefly due to faulty diet, hygiene and want of sunlight also being responsible. The various diets causing rickets are :

1. Starch-containing foods.
2. Condensed milk.
3. Patent foods.
4. Excessively diluted milk.

Rickets is a deficiency disease through the lack of the so-called vitamin D. Milk, cod-liver oil, cabbage and spinach are rich in this vitamin.

It is also important, as we have pointed out elsewhere, to pay attention to the physiological balance in all respects. Anything which may tend to interfere with the nutritional workings of the body, *e.g.* food errors, illness, and hygiene, may create rickets. The commonest age to find rickets is early in the second year, though it also occurs earlier.

The cardinal symptoms are :—Pot-belly; beading of the ribs (the rickety rosary); the prominent forehead and too open fontanelle; late dentition; flabby muscles; bent legs; and very often a response to Chvostek's signs for tetany.

Treatment. Prescribe a diet which conforms to physiological essentials, paying especial care to fat. Cod-liver oil is invaluable, and of late years sunlight treatment and fresh air have worked wonders. It is advised to supplement the sun by artificial light, using either the Carbon Arc or Quartz Mercury Vapour lamp.

TUBERCULOSIS

It is of the greatest importance to remember that tuberculosis is conveyable through milk. It is interesting to note that Dr. Still's observations show that 29 per cent. of tuberculosis in children are due to alimentary infection. This figure is only a very little higher than Professor Findlay's figures at Glasgow.

It is the duty of all doctors to educate their patients and so strive to bring about a state when it is possible to obtain certified milk. By this we mean that the cows should be tuberculin tested every six months, and that bacterial examination should show a *maximum* count of only 30,000 bacteria per c.c.

Statistics taken by Dr. Still show that tuberculosis is now recognised in very young children. In the second year it is particularly evident, there being comparatively few cases the first six months, double this number in the second six months, and double this again from the twelfth to the twenty-fourth month, after which the curve drops.

SCLEREMA NEONATORUM

This is a curious hard condition of the body surface, which occurs in babies. There may be respiratory embarrassment.

There are three varieties :

(1) *Sclerema adiposum.* Diffuse indurations, leaving free palms of hands and soles of feet, scrotum and dorsum of penis. No pitting on pressure. Seen in premature and diseased infants. Temperature subnormal.

(2) *Scleroedema.* Swelling and increased volume of affected part. Oedema and induration of lower limbs especially. More common in premature infants.

(3) *Scleroderma.* Begins in second or third week. Attacks well-nourished infants. Localised areas—hard infiltration—definitely marked off. Prognosis favourable.

It is best treated by injection of 20 c.c of saline solution into the abdominal cavity, or else 16–20 c.c. of 10 per cent. glucose are injected into the anterior fontanelle.

It should be treated on lines similar to those of toxaemia of pregnancy.

The cause is unknown : it is suggested that it may be due to coagulation of fat.

APPENDIX I

STATISTICS, 1903–10

TABLE No. I.—*Showing Nature and Number of Cases in Extern Maternity* *

Total deliveries	15543
Abortions	1819
Presentations—	
Face	42
Face to pubes	142
Brow	13
Breech and footling	458
Transverse and oblique	71
Twins	202
Triplets	2
Prolapse of funis	68
Haemorrhage—	
Accidental { 1. Concealed, 2. Revealed }	47
Unavoidable	72
Post-partum	183
,, ,, secondary	3
,, ,, traumatic	3
Operations—	
Forceps	274
Versions	147
Manual removal of placenta	173
Perforation	4
Decapitation	1
Hydatidiform mole	5
Eclampsia	3
Mania	1
Hydramnios	49
Prolapse of uterus	1
Rupture of uterus	5
Complete laceration of perineum	5
Phlegmasia	7
Maternal mortality	57
Infantile conditions (partial list)	
Spina bifida	5
Anencephalus	8
Hydrocephalus	20
Meningocele	3
Talipes	7
Intra-uterine amputation of arm	1
Congenital oedema	1
Maldevelopment of jaw	1
Pemphigus	1
Ascites	1
Cyclops monster	1
Fractured skull	3
Congenital intestinal obstruction	2
Foetus papyraceus	1

Extern Maternal Mortality

Septicaemia	16
Post-partum haemorrhage	9
Accidental haemorrhage	7
Placenta praevia	5
Pulmonary embolus	3
Ruptured uterus	2
Shock from manual removal	2
Cardiac disease	3
Pneumonia	1
Phthisis	1
Pernicious anaemia	1
Uraemia	1
	51

* Many maldevelopments, such as Hare-lip and Cleft palate, have not been recorded.

TABLE No. II.—*Showing Nature and Number of Cases treated in Intern Maternity* *

Total admissions	14540
,, deliveries	13924
Abortions	413
Hydatidiform mole	7
Primiparae	5018
Presentations—	
Face	23
Face to pubes	130
Brow	18
Breech and footling	359
Transverse and oblique	48
Twins	187
Triplets	1
Impacted shoulders	3
Prolapse of funis	75
Lacerated perineum, incomplete	3314
Lacerated perineum, complete	15
Hyperemesis	12
Hydramnios	42
Hydrorrhoea	2
Hernia of gravid uterus	1
Deformed pelves	91
Haemorrhage—	
Accidental	47
Unavoidable	41
Post-partum	195
,, ,, secondary	4
Haematoma of vulva	6
Operations—	
Forceps	527
Version	101
Induction of labour	46
Caesarean section	15
Hysterotomy	5
Pubiotomy	9
Symphysiotomy	2
Manual removal of placenta	141
Decapitation and Perforation	4
Phlegmasia alba dolens	8
Puerperal ulcer	35
Mastitis	26
Galactocele, very large	1
Rupture of cervix (operative)	9
,, uterus	8
Atresia of vagina	2
Eclampsia	74
Mania	17
Pneumonia	3
Typhoid	1
Urticaria herpetiformis	1
Epilepsy	5
Chorea	1
Cutaneous emphysema	1
Maternal mortality	49
Infantile mortality	
Died in Hospital	210
Still-born—	
Recent	267
Macerated	306
Putrid	10
Infantile conditions (partial list)—	
Anencephalus	19
Hydrocephalus	12
Spina bifida	21
Ophthalmia	18
Meningocele	2
Encephalocele	2
Cephal-haematoma	17
Cleft palate	9
Imperforate anus	8
Absence of radius and thumbs	1
Talipes	32
Intussusception	1
Ectropion vesicae	1
Monsters	3
Umbilical hernia requiring immediate operation	3
Foetus papyraceus	1
Genu recurvatum	1

Intern Maternal Mortality

Septicaemia	15
Pyaemia	6
Eclampsia	6
Labour shock	3
Ruptured uterus	2
Accidental haemorrhage	1
Concealed accidental haemorrhage	1
Placenta praevia	1
Post-partum haemorrhage	2
Caesarean section	1
Pneumonia	3
Phthisis	2
Typhoid fever	1
Puerperal insanity	1
Chronic endocarditis and nephritis	1
Cardiac disease	2
Hemiplegia	1
	49

* For other rare abnormalities, *see* Hospital Reports.

TABLE No. III.—*Application of Forceps*

Indication.	No.	Dead Children.
Delayed second stage	408	24
Prolapse of cord	17	3
Contracted pelves	20	6
Persistent occipito-posterior	26	3
Eclampsia	15	6
Cardiac disease	5	2
Fibroid uterus	1	0
Early rupture of membranes	3	0
Induction of labour	2	1
Accidental haemorrhage	5	1
Face presentation	2	0
Brow presentation	4	2
Ruptured uterus	1	1
Phthisis	1	0
Threatened rupture of uterus	1	0
Sepsis	2	2
Mania	1	1
Oedema and albuminuria	1	0
Another	1	0
Total	516	52

Showing Number of Pregnancy

I-para	407
II-para	42
III-para	25
IV-para	7
V-para and over	39
Total	520

TABLE No. IV.—*Intern Cases of Accidental Haemorrhage, both Revealed and Concealed*

Treatment—

Plugged	22
Untreated	12
Forceps	5
Version	2
Rupture of membranes	6
Total	47

Mortality—

Maternal	2 = 4·25 per cent.
Foetal	27 = 57·44 per cent.

TABLE No. V.—*Intern Cases of Placenta Praevia*

Treatment—	
Version	34
Spontaneous delivery	7
Total	41
Mortality—	
Maternal	2 = 4·87 per cent.
Foetal	27 = 65 per cent.

TABLE No. VI.—*Causes of Morbidity other than Uterine*

Alveolar abscess	4
Bronchitis	10
Constipation	44
Cracked nipples	1
Cystitis	2
Eclampsia	18
Enteric fever	1
Erysipelas	2
Haemorrhoids	3
Heart disease	8
Impetigo	2
Inflammation of symphysis	1
Influenza	22
Mania	2
Mastitis	26
Phlegmasia	8
Pleurisy	1
Pneumonia	9
Puerperal ulcer	35
Pulmonary tuberculosis	11
Pustular eruption on vulva	1
Renal disease	1
Rheumatism	1
Septic sore on chin	1
,, ,, thumb	2
Slough on thigh (hypodermic)	1
Suppurating abdominal wound	1
,, sinus following nephrectomy	1
,, symphysiotomy wound	1
Syphilis	5
Tonsillitis	1
Tuberculosis of elbow	1
Ulcer, infected, of leg	2
Urticaria herpetiformis	1
	230

YEARLY TABLES

1903–1904. Table No. I.—*Cases of Contracted Pelvis*

Name	Age	Para.	Pelvic Measurements					Mode of Delivery	Result to Child	Remarks
			O.V.	Trans.	Ext. C.	L.-C.	L.-S.			
M. G.	20	I.	8	13	—	—	—	—	Dead	Symphysiotomy
M. H.	23	I.	8	13	15	28	24	—	Alive	Caesarean section
H. H.	24	I.	8	13	17	—	24	Forceps	Alive	Coxalgia
M. M.	32	VII.	9½	13	—	—	—	Version	Dead	Induced labour

Table No. II. A.—*Morbidity*

Temperature	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
100·8° to 101·2°	3	4	3	3	5	4	5	6	1	–	1	2	37
101·2° to 102·2°	–	1	4	8	4	4	4	3	5	2	2	1	38
102·2° to 104°	1	1	4	2	10	7	6	5	5	8	5	4	58
104° and above	–	–	–	–	7	4	3	5	2	4	–	1	26
Total . .	4	6	11	13	26	19	18	19	13	14	8	8	159
Percentage .	–	–	–	–	–	–	–	–	–	–	–	–	8·42

Table No. II. B.

Temperature	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
99°, P. 90 .	9	11	13	14	28	19	26	20	19	18	15	10	202
Percentage	–	–	–	–	–	–	–	–	–	–	–	–	10·70

1904–1905. TABLE No. I.—*Cases of Contracted Pelvis*

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	REMARKS
			C.V.	Trans.	Ext. O.	I.-O.	I.-S.			
S. F.	33	II.	7	11½	20	27	28	Spontaneous	Alive	Labour induced.
A. O'R.	29	I.	5½	11	17	24¾	25	Caesarean section	Alive	
J. B.	34	IV.	6⅓	10⅓	—	25½	25⅓	Caesarean section	Alive	
M. T.	—	II.	7½	10	17	24	24	Forceps	Dead	
M. F.	26	I.	6	—	15½	27	27	Caesarean section	Dead	
E. C.	41	XI.	8	11½	18	28	30	Spontaneous	Alive	Labour induced.
A. O'C.	36	I.	8½	—	18½	28	28	Forceps	Alive	Head above brim.
E. S.	36	IV.	9¾	—	18	27	24	Version	Alive	
E. F.	38	III.	8½	10	17½	27½	25	Forceps	Alive	Other deliveries, induced labour. This was full term.
A. P.	23	II.	7⅜	—	16½	28½	27	Caesarean section	Alive	Caesarean section, second time.
B. M.	33	I.	7¼	11¾	17	27	25	Version	Dead	Face presentation.
M. C.	36	II.	9	—	—	—	—	Version	Alive	Prolapse of cord.

1904–1905. TABLE No. II. A.—*Morbidity* 100·8° *and over*

Temperature	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
100·8° to 101·2°	1	6	4	3	3	1	1	2	7	3	2	3	36
101·2° to 102·2°	6	2	3	5	2	8	5	–	3	2	7	6	49
102·2° to 104°	3	6	4	1	4	2	4	3	2	6	3	6	44
104 °and over	–	–	–	2	–	–	–	1	–	–	1	1	5
Total	10	14	11	11	9	11	10	6	12	11	13	16	134
Percentage	–	–	–	–	–	–	–	–	–	–	–	–	7·03

TABLE No. II. B.—*Temperature and Pulse over* 99° *and* 90

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Temp. and pulse over 99° and 90	10	12	8	6	13	10	12	16	8	11	11	10	127
Percentage	–	–	–	–	–	–	–	–	–	–	–	–	6·67

1905–1906. TABLE No. I.—*Contracted Pelves*

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	REMARKS
			C.V.	Trans.	Ext. C.	I.-C.	I.-S.			
M. H.	30	II.	8	13	15	28	25	Caesarean section	Alive	Second operation.
S. F.	34	III.	7	11·5	20	27	28	Version	Dead	Induction at 36th week; 2nd time.
M.K.	43	XI.	6	11·5	18	31	29	Spontaneous	Alive	Induction, 37th week; 8th time.
M. G.	22	II.	8	13	—	—	—	Spontaneous	Alive	Symphysiotomy performed previously.
E. K.	27	III.	9	11·5	18·5	29	27	Forceps	Dead	Induction, 39th week; 3rd induction.
M. W.	27	II.	7·2	—	18	28	26	Spontaneous	Alive	Labour prolonged for 20 hours; previous confinement normal.
S. M.	23	III.	7·2	13	18	31	31	Version	Dead	Labour induced, 37th week; head did not fix, so podalic version was done.
T. M.	28	III.	7	12	17	27	27	Spontaneous	Dead	Induction, 28th week; breech presentation. Previous labours, 1st term, forceps; 2nd term, version.
J. F.	24	III.	7·7	11·2	20·5	28	27	Expression	Alive	Induction, 38th week; prolapse of cord. Previous labours, term, forceps; both children dead.
M. P.	16	I.	8	11·5	19	25	25	Spontaneous	Alive	Face presentation.
L. K.	21	I.	6·8	—	15·5	26	24·5	Forceps	Alive	Prolonged labour; small head, which moulded well.
G. L.	27	I.	7	11	20	27	26·5	Expression	Alive	Induction, 32nd week; compound presentation, head and hand. Small child; weight, 4¾ lbs.
M. T.	30	III.	7·5	10	17·5	24	24	Forceps	Alive	Term, occipito-posterior. Dorsal curvature.

1905–1906. Table No. II. A.—*Morbidity*

Estimation proposed by British Medical Association	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Temp., of 100° or over, counting from the end of first 24 hours of the puerperium to 8th day inclusive	4·44	5·19	8·17	10·79	11·87	8·84	6·62	14·10	8·23	8·13	4·57	10·25	
	Total percentage . .												8·43

Table No. II. B.—*Morbidity*

Rotunda Estimation.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Temp. and pulse over 99° and 90 for three consecutive takings (24 hours in all)	2·22	3·25	5·72	3·52	5·00	6·80	6·07	5·76	4·11	4·06	1·71	3·84	
	Total percentage . .												4·33

Table No. II. C.

Number of Lacerated Perineums showing Morbidity for Year

English Estimation	33
Rotunda Estimation	10
Both Estimations	28
Total	71

Operative Cases showing Morbidity

Forceps (English, 3; Rotunda, 2; both, 8)	13
Manual removals (English, 2; Rotunda, 1; both, 5) . . .	8
Induction of labour (English, 1)	1
Abortion removal (English, 1)	1
Breech (English, 1; both, 1)	2
Plugging for P.P.H. (both, 1)	1
Total	26

1906–1907. TABLE No. I.—*Contracted Pelves*

All internal measurements made with Skutsch Pelvimeter

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	REMARKS
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.			
E. L.	28	I.	6·5	10	16·5	29	27	Pubiotomy. Int. Version	Alive	Prolapse of cord; manual removal of placenta.
S. M.	27	IV.	6	—	16·5	31·5	30	Caesarean section	Alive	
C. S.	24	V.	7·5	12	19	26	23	Pubiotomy. Forceps	Dead	Walcher position for one hour before forceps; head advanced into pelvis and stopped.
B. G.	33	IV.	8	11·5	18·5	30	25	Pubiotomy	Alive	Spontaneous delivery. Os fully dilated before operation.
A. W.	26	III.	8	11	17·5	27·5	25	Forceps	Alive	History of previous dead children.
A. M'K.	42	XI.	7	12	18	27	25	Induced labour. Bougies 3 days in succession. Membranes ruptured. Int. version and immediate delivery	Alive	Hydramnios. History of 10 full term pregnancies with forceps delivery; 5 dead children. Marked exostosis on int. surface of pubes.
S. N.	24	II.	9	12	18	26	22	Forceps failed. Version with difficulty	Dead	Mother died; general peritonitis.
L. B.	24	I.	7	—	18	27	24	Forceps unsuccessful. Pubiotomy and forceps	Alive	
M. B.	24	I.	8	11·5	17	27	24	Spontaneous delivery	Alive	
M. C.	30	I.	5·4	9·7	15·5	24·5	23	Caesarean section	Alive	Achondroplasiac dwarf.
E. T.	30	I.	7	11	—	—	—	Induction of labour. Version	Macerated	Hydramnios.
M. A.	32	I.	6·25	11·25	17·5	27	25	Caesarean section	Alive	
S. F.	36	IV.	7	11·5	20	28	27	Pubiotomy. Spontaneous delivery	Alive	
D. K.	23	II.	7·75	—	16	27	24	Spontaneous delivery	Alive	

1906–1907. Table No. III. A.—*Morbidity*

British Medical Association Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	152	149	148	137	165	144	177	150	159	165	149	146	1841
Cases Morbid	15	9	11	12	14	8	11	11	5	10	3	9	118
Percentage	9·86	6·04	7·43	8·75	8·48	5·55	6·21	7·33	3·14	6·06	2·01	6·16	6·41

Total number . 118
Total percentage . 6·41

Table No. III. B.

Rotunda Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	158	153	153	142	168	148	181	156	162	172	156	153	1902
Cases Morbid	7	4	5	12	10	3	8	8	5	5	5	4	76
Percentage	4·43	2·61	3·27	8·45	5·95	2·02	4·42	5·13	3·09	2·90	3·21	2·61	3·99

Total number . 76
Total percentage . 3·98

Table No. III. C.—*Lacerated Perineums showing Morbidity for Year*

English Estimation	23
Rotunda Estimation	1
Both Estimations	25
Total	49

Table No. III. D.—*Operative Cases, showing Morbidity*

Forceps (English, 5; both, 4)	9
Manual removals (English, 1; both, 4)	5
Induction of labour (both, 1)	1
Abortion (both, 1)	1
Placenta praevia (English, 1; both, 2)	3
Pubiotomy (both, 1)	1
Breech (English, 1)	1
Total	21

Eleven of these cases associated with lacerated perineum; one case of placenta praevia had manual removal not listed. Pubiotomy, associated with forceps and manual removal, not separately listed.

1907–1908. Table No. I.—*Contracted Pelves*

All internal measurements made with Skutsch Pelvimeter

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	Weight of Child	Result to Mother	Remarks
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.					
A. F.	36	IV.	6·25	—	17·5	25	24	Caesarean section	Alive	—	Died	See Mortality Table.
A. W.	24	IV.	8	11	18·5	27	25	Natural	Dead	7½	Recovery	Prolapsed pulseless cord on admission; depressed fracture right parietal bone.
E. B.	24	II.	8·5	10·5	19	27	25	Natural	Alive	7¼	Recovery	Pubiotomy, May, 1907.
A. M'E.	31	I.	6·75	11	18	25	22·5	Induction of prem. labour	Dead	5¼	Recovery	Came up long before term.
J. T.	35	VI.	8·75	—	17	24	23·5	Natural	Alive	8¼	Recovery	
C. G.	20	I.	9	—	16·5	24	20	Natural	Alive	5½	Recovery	Head ballotting above brim until os fully dilated.
K. O'C.	36	X.	9	—	21	29·5	27	Internal version	Alive	9¼	Recovery	Head unfixed; os fully dilated. History of previous normal deliveries—vertex and breech.
E. R.	25	I.	9	—	17	24	23	Walcher's position Natural delivery	Alive	6¼	Recovery	Patient in labour 24 hours; head unfixed. Walcher's position, 45 minutes; head fixed, and child born in 3 hours.
N. D.	23	I.	9	12	19·25	29·5	28	Internal version	Dead	7½	Recovery	Membranes ruptured 12 hours before admission. Prolapse of cord and hand.
M. B.	31	I.	8	11·20	18·5	28·5	26	Forceps	Dead	—	Recovery	

1907–1908. TABLE No. II.—*Eclampsia*

Name	Age and Para	Condition on Admission	Urine	No. of Fits			Treatment	Result to Mother	Result to Child	REMARKS
				Before Labour	During Labour	After Labour				
M. B., admitted Nov. 9, '07	28 years II.	Had a fit on the way to waiting ward	Albumin abundant	2	—	—	Morphine; purgatives; enemas (3). Delivered Nov. 10, '07	Rec.	A	Admitted twenty-four hours before delivery, not in labour.
E. M., admitted Dec. 10, '07	30 years II.	Unconscious	Albumin abundant	6	—	—	Morphine; stomach and bowel washed out; enema; purgatives. Delivered Dec. 11, '07	Rec.	A	Semi-conscious up to time of delivery.
B. D., admitted Dec. 23, '07	24 years I.	Unconscious	Albumin abundant	—	6	—	Morphine; purgatives; forceps; os three-quarter open. Delivered Dec. 23, '07	Rec.	A	Admitted in labour.
S. H., admitted Jan. 1, '08	32 years I.	Unconscious	Albumin abundant	13	—	—	Morphine; stomach and bowel washed out; bled 12 oz.; saline intravenous 1½ pts.; purgatives; stimulation. Delivered Jan. 1, '08	Died 1/2/08	D	Patient operated on about a year before admission after eight years' sterility; a posterior division was done. No fit for forty-four and a half hours before death. Conscious for several hours before delivery. *See* Mortality Report.
M. K., admitted Mar. 11, '08	20 years I.	Apparently in good health; in labour	Albumin abundant	—	—	2	Morphine; bowel washed out; purgatives. Delivered Mar. 12, '08	Rec.	A	Fits started two and a half hours after delivery.

1907–1908. TABLE No. II.—*continued*

Name	Age and Para	Condition on Admission	Urine	No. of Fits			Treatment	Result to Mother	Result to Child	REMARKS
				Before Labour	During Labour	After Labour				
E. C., admitted Mar. 14, '08	18 years I.	Unconscious; oedema of labia and legs	Albumin abundant	10	—	—	Morphine; bowel washed out. Delivered Mar. 15, '08	Rec.	D D	Twins; premature; six months.
L. S., admitted Apr. 11, '08	28 years I.	Unconscious. History of two weeks' oedema	Albumin abundant	13	—	—	Morphine; bowel and stomach washed out; purgatives. Delivered April 12, '08	Rec.	D A	Twins; one macerated. Patient had phthisis.
M. N., admitted Apr. 19, '08	39 years I.	Unconscious	Albumin abundant	10	—	—	Morphine; bowel and stomach washed out; purgatives. Delivered April 20, '08	Rec.	D	
M. G., admitted May 27, '08	20 years I.	Unconscious	Albumin abundant	Several before admission; 3 after	—	—	Morphine; bowel and stomach washed out; purgatives. Delivered May 29, '08	Rec.	D	Conscious twenty-four hours before onset of labour.
J. C., admitted June 2, '08	27 years I.	—	Albumin abundant	—	—	20	Morphine; atropine; stomach and bowel washed out; submammary infusion of salt solution. Delivered June 3, '08	Rec.	A	Child died shortly after birth. Fits started three and a half hours after delivery.
M. B., admitted June 5, '08	25 years I.	Apparently in good health	Albumin abundant	—	—	1	Morphine; stomach and bowel washed out. Delivered June 15, '08	Rec.	A A	Twins. Fits started two and a half hours after delivery.
M. H., admitted June 8, '08	21 years I.	Apparently in good health	Albumin abundant	—	6	—	Morphine; stomach and bowel washed out. Delivered June 12, '08	Rec.	A A	Glycosuria and albuminuria; post-partum haemorrhage.

1907–1908. TABLE No. III. A.—*Morbidity*

British Medical Association Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	146	152	139	136	174	195	190	211	172	189	163	153	2020
Cases Morbid	7	8	5	7	10	15	9	13	12	9	7	5	107
Percentage	4·79	5·26	3·60	5·15	5·75	7·69	4·74	6·16	6·98	4·76	4·29	3·27	5·30

Total number . 107
Total percentage . 5·30

TABLE No. III. B.

Rotunda Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	151	156	142	140	178	197	193	215	173	193	165	157	2060
Cases Morbid	6	6	5	7	7	8	6	7	5	7	7	4	75
Percentage	3·97	3·85	3·52	5·00	3·93	4·06	3·11	3·26	2·89	3·63	4·24	2·55	3·64

Total number . 75
Total percentage . 3·64

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Table No. IV.—*Operative Cases, showing Morbidity*

Forceps (both, 7; English, 7; Rotunda, 1)	15
Incomplete abortion (both, 1)	1
Induction of abortion (both, 1)	1
Induction of labour (both, 1)	1
Manual removal of adherent placenta (both, 1; English, 1)	2
Placenta praevia. Version (both, 2)	2
Ruptured uterus (English, 1)	1
Total	23

Of these cases twelve forceps cases associated with lacerated perineums; one version associated with lacerated perineum; one forceps case associated with manual removal of adherent placenta not separately listed.

Table No. IV. A.—*Percentage Operative Morbidity B.M.A. Estimation*

Forceps	17·28 per cent.
Manual removals	22·22 per cent.
Version for placenta praevia	25·00 per cent.

Table No. V.—*Lacerated Perineums, showing Morbidity*

B.M.A. estimation alone	16
Rotunda estimation alone	3
Both estimations	10
Total	29

Of these cases twelve were associated with forceps; one was associated with eclampsia.

The following Tables are based on those cases morbid by B.M.A. Estimation :—

Table No. VI.—*Duration of Stay in House of Morbid Cases*

Under 10 days	46, including 2 deaths.
10–19 days	50, including 3 deaths.
20–29 days	6, including 1 death.
30–39 days	3
40–49 days	2, including 1 death.
Total	107

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Table No. VII.—*Duration of Temperature*

Under 10 days	86, including 4 deaths.
10–19 days	15, including 1 death.
20–29 days	3
30–39 days	1
40–49 days	1, including 1 death.
Total	106

One death, Caesarean section, unaccompanied by temperature.

Table No. VIII.—*Highest Temperature Recorded*

100°	100·9°	31, including 1 death.
101°	101·9°	37, including 2 deaths.
102°	102·9°	21, including 1 death.
103°	103·9°	12, including 1 death.
104°	104·9°	5, including 1 death.
	Total	106

Of the 2060 cases delivered, 126 showed a temperature over 100·4° F., but 20 of these occurred on the first day, and did not come under the morbidity rule of the B. M. A.

Table No. IX.—*Treatment of Morbid Cases*

No treatment	42
Vaginal douche only	10
Uterine douche	51
Quinine only	4
Total	107

In 9 cases quinine was given in conjunction with other treatment. Antistreptococcic serum was used in 4 cases, including 1 case that died.

Table No. X.—*Uterine Douches*

20 cases received 1 douche.
13 cases received 2 douches.
10 cases received 3 douches.
4 cases received 4 douches.
3 cases received 6 douches.
1 case received 7 douches.

Total . 51

For report of uterine cultures, *see* Pathological Report.

1908–1909. TABLE No. I.—*Contracted Pelves*

All internal measurements made with Skutsch Pelvimeter

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	Weight of Child	Result to Mother	REMARKS
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.					
J. W.	30	I.	8	10	17	26	25½	Breech. Normal	A	3⅓	A	Premature 7 months. Baby died in 2½ hours.
B. G.	19	I.	8	11	17	25	23½	Vertex. Normal	A	7	A	
E. D.	22	I.	8	10	18½	26	22	Vertex. Normal	A	5¼	A	Head fixed late in labour. Walcher's position. Scopolamine and morphine.
A. W.	25	V.	8	11	18½	27	25	Caesarean section	A	7¼	A	Previous children dead born. One prolapsed cord and fractured skull. Others forceps and fractured skulls.
M. A. K.	22	I.	7·5	—	17½	26½	25	Bi-polar version. Perforation	D	9	A	Prolapse of cord. Brow. Aftercoming head stuck. Perforated.
E. G.	26	II.	8⅗	10⅕	18	26½	24	Internal version	D	5½	A	Prolapsed cord, stopped pulsating when version started. Membranes ruptured some hours and liquor amnii drained away.
J. M.	19	I.	8	12	16	28	26	Breech. Extraction	A	7¾	A	Prolapse of cord. Breech unfixed. Great difficulty with aftercoming head.
L. B.	35	I.	6	10¾	17½	27½	25½	Version	D	5¾	A	Head presenting. Cord prolapsed.
M. D.	23	I.	8	12⅕	19	28	26	Symphysiotomy. Version	D	6½	A	Membranes ruptured with onset of labour.
C. K.	23	I.	8	11½	20	26	25	Normal	A	8	A	
C. S.	33	II.	9	12¼	20½	28	25½	Induction of labour. Forceps	A	9	A	First child normally delivered dead.
A. T.	25	I.	7	11½	16	26	27	Breech	D	5½	A	Macerated.
M. S.	24	III.	8½	—	—	—	—	Version	D	6⅛	A	Transverse. Macerated.
M. G.	35	I.	6	—	16	26	25½	Hysterotomy	A	5¾	A	

1908–1909. TABLE No. II.—*Eclampsia*

Name	Age and Para	Condition on Admission	Urine	No. of Fits			Treatment	Result to Mother	Result to Child	REMARKS
				Before Labour	During Labour	After Labour				
C. D., admitted Feb 2, '09	20 years I.	Conscious	Albumin abundant	—	—	6	Morphine. Bowel washed out (2). Purgatives. Infusion under breasts. Poultices to loins	Rec.	A D	Delivered Feb. 2. First fit nine hours later.
C. M., admitted Feb 18, '09	23 years II.	Conscious	Albumin abundant	—	—	1	Morphine. Stomach washed out. Purgatives	Rec.	A	Delivered Feb. 18. Fit 1¼ hours later.
T. K., admitted June 10, '09	46 years I.	Unconscious	Albumin abundant	8	1	—	Morphine. Stomach washed out. Bowel washed out. Poultices to loins. Purgatives	Rec.	D	Delivered June 11.
B. I., admitted June 14, '09	34 years I.	Conscious	Albumin abundant	—	—	5	Morphine. Bowel washed out (2). Purgation	Rec.	A	Delivered June 14. First fit two hours after delivery.
E. H., admitted June 15, '09	29 years I.	Unconscious	Albumin abundant	8	1	1	Morphine. Stomach washed out. Bowel washed out. Purgatives. Poultices to loins. Stimulation. Oxygen. Artificial respiration (3 times)	Rec.	D	Chloral gr. xx before admission. Pulse very poor, cyanosis on admission; 3 times during day respiration ceased altogether. Delivered June 15.
M. W., admitted July 29, '09	40 years II. 1st preg. abortion	Oedema of legs. Conscious	Albumin abundant	—	1	—	Morphine. Bowel washed out. Forceps	Rec.	A	Fit during second stage. Delivered July 29.
M. McK. admitted Sept. 30, '09	20 years I.	Unconscious	Albumin abundant	4	—	—	Morphine. Bowel washed out. Poultices to loins. Purgatives	Rec.	D	Child macerated. Delivered Oct. 5.

1908–1909

TABLE No. III. A.—*Morbidity*

British Medical Association Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	165	152	137	149	178	171	171	169	182	204	166	129	1973
Cases Morbid	4	3	4	4	9	6	5	7	7	9	8	7	73
Percentage	2·42	1·98	2·92	2·68	5·06	3·51	2·92	4·14	3·84	4·41	4·82	5·43	3·70

Total number . 73
Total percentage . 3·70

TABLE No. III. B.

Rotunda Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	169	153	140	154	183	177	176	180	193	212	175	133	2045
Cases Morbid	5	2	3	3	9	4	2	4	4	8	5	2	51
Percentage	2·96	1·31	2·14	1·95	4·92	2·26	1·14	2·22	2·07	3·77	2·86	1·50	2·49

Total number . 51
Total percentage . 2·49

TABLE No. IV.—*Operative Cases showing Morbidity*

Forceps (both, 4; B.M.A., 4)	8
Induction of labour (B.M.A., 2)	2
Manual removal of placenta (both, 2; B.M.A., 3)	5
Rupture of membranes for hydramnios (both, 1)	1
Post-partum haemorrhage (both, 1)	1
Symphysiotomy (B.M.A., 1)	1
Version (B.M.A., 2)	2
Total	20

TABLE No. IV. A.—*Percentage Operative Morbidity, B.M.A. Estimation*

Forceps	9·88 per cent.
Manual removals	33·33 per cent.

TABLE No. IV. B.—*Rotunda Estimation*

Forceps	4·94 per cent.
Manual removals	13·33 per cent.

1909–1910. TABLE No. I.—*Contracted Pelves*

All internal measurements made with Skutsch's Pelvimeter

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	Weight of Child	Result to Mother	REMARKS
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.					
R. N.	30	I.	8·5	12·4	19·5	26·5	23·5	Subcutaneous pubiotomy; forceps	Alive	8	Recovered	Walked 17th day. Baby died 11th day of congenital syphilis. Sixty-four hours in labour, forceps failed to deliver. X-ray showed fibrous union. Measured after pubiotomy.
C. N.	39	VII.	7·8	13·4	16	28·5	28	Forceps	Dead	8	Recovered	Sent in from extern. Membranes ruptured 30 hours. F. H. 100. Head fixed while patient was being brought in cab.
E. L.	28	III.	6·5	10	16·5	29	27	Extra-peritoneal Caesarean section	Alive	9⅛	Recovered	Sent in from extern. 24 hours in labour. Examined by 8 different men. Infection of superficial wound. First labour pubiotomy. Second transverse version, perforation.
M. G.	23	IV.	8	13	18·5	27	25	Extra-peritoneal Caesarean section	Alive	7⅝	Recovered	Labour 20 hours. Walcher's position 9½ hours. Os fully dilated. Bandl's ring nearly to umbilicus. Foetal heart 160–170. Temperature 99°. Pulse 86. First labour symphysiotomy; 2nd and 3rd normal.

TABLE No. I.—*continued*

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	Weight of Child	Result to Mother	REMARKS
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.					
E. B.	19	II.	8	—	16·5	28·5	26	Prolapse of cord, internal version, and extraction	Alive	$7\frac{5}{8}$	Recovered	First labour normal.
M. F.	22	I.	9	—	19	26·75	25·5	Breech	Alive	$5\frac{1}{4}$	Recovered	——
M. O'C.	34	II.	9	—	19	26	24	Spontaneous vertex	Alive	$6\frac{7}{8}$	Recovered	First child still-born.
M. K.	22	IV.	9·2	12·4	18	26·5	25	Prolapse of cord, internal version, and extraction	Alive	$6\frac{7}{8}$	Recovered	First three children still-born from prolapse of cord.
E. F.	24	I.	8	12·8	20	27	25	Spontaneous vertex	Alive	$7\frac{1}{4}$	Recovered	Thirty-two and a-half hours in labour. Head fixed late in first stage. Came down in transverse diameter.
R. T.	34	VI.	6·2	13·2	17	28·5	27	Prolapse of cord, internal version, and extraction	Alive	$5\frac{3}{8}$	Recovered	Fractured skull, half the head crushed in. Immediately raised with one blade of bullet forceps. Died 3rd day deeply jaundiced. Autopsy showed skull and brain uninjured.

TABLE NO. I.—*continued*

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	Weight of Child	Result to Mother	REMARKS
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.					
M. N.	27	I.	6	11·6	16·5	27	26	Perforation and cephalotripsy	Dead	7⅛	Recovered	Pulseless cord presenting. Fifty hours in labour.
F. M.	25	I.	9	12	16	24·5	22·5	Spontaneous vertex	Alive	5¾	Recovered	Head fixed during first stage.
S. M.	28	VII.	9·2	12	19	28	27	Bipolar version, placenta praevia, prolapse of cord	Alive	8⅜	Recovered	Always had prolapse of cord.
M. K.	40	XI.	9	—	22	32	28	Perforation and cephalotripsy	Dead	8½	Recovered	Child dead. Forceps slipped.
B. M.	22	I.	8·2	11·2	—	—	—	Spontaneous vertex	Alive	6	Recovered	Head fixed end of first stage.
B. S.	24	V.	7·6	12·2	18	25	23	Transverse bipolar version	Alive	6	Recovered	——
C. S.	28	VII.	7·5	12	19	26	23	Spontaneous vertex	Alive	7¾	Recovered	Measurements taken before pubiotomy in 1907. Pubiotomy 1907. Spontaneous delivery 1908.
S. M.	28	V.	6	9	16·5	31·5	30	Caesarean section	Alive	7	Recovered	Caesarean section.
E. S.	21	I.	8·6	11·4	18	27·5	25	Forceps	Alive	6½	Recovered	——
J. W.	32	II.	8	10	18	27	25	Forceps	Alive	5⅞	Recovered	Child died 4th day.

TABLE No. I.—*continued*

Name	Age	Para	Pelvic Measurements					Mode of Delivery	Result to Child	Weight of Child	Result to Mother	REMARKS
			C. V.	Trans.	Ext. C.	I.-C.	I.-S.					
E. F.	22	III.	8·8	11·6	16	24	21	Transverse external version, spontaneous vertex	Dead	7¼	Recovered	Extensive cerebral haemorrhage. Child alive when 2nd stage started. Foetal heart 132. Second stage lasted one hour. Membranes ruptured 10 hours. Cord tightly around neck.
M. D.	24	III.	8	12·8	18	28	25	Prolapse of cord, internal version, subcutaneous pubiotomy	Alive	6¾	Recovered	First labour, symphysiotomy, July, 1909. Second pregnancy, abortion, Nov., 1909.
M.O'S.	27	IV.	7	—	17	29	27	Subcutaneous pubiotomy, forceps	Alive	7⅝	Recovered	Previous labours forceps. Children still-born. Second stage 4 hours. Walcher's position 4 hours. Head made no attempt to fix.
M. C.	33	III.	8·2	13	18·5	27	24·5	Subcutaneous pubiotomy, forceps	Alive	7	Recovered	Previous labours perforation. Labour this time 38 hours. Walcher's position 20 hours. Forceps failed.

1909–1910

TABLE No. III. A.—*Morbidity*

British Medical Association Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	160	161	167	162	197	165	188	185	217	199	190	156	2147
Cases Morbid	7	1	8	10	18	6	8	7	9	5	8	6	93
Percentage	4·37	0·62	4·79	6·17	9·14	3·64	4·26	3·78	4·15	2·51	4·21	3·85	4·33

Total number . 93
Total percentage . 4·33

TABLE No. III. B.

Rotunda Estimation	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Cases	166	167	174	167	204	171	194	187	226	203	197	166	2222
Cases Morbid	3	3	4	4	12	6	7	3	5	1	4	6	58
Percentage	1·81	1·80	2·30	2·39	5·88	3·51	3·61	1·60	2·21	0·49	2·08	3·61	2·61

Total number . 58
Total percentage . 2·61

TABLE No. IV.—*Operative Cases, showing Morbidity*

Forceps (both, est. 6; B.M.A., est. only 3)	9
Accidental haemorrhage (both, est. 1)	1
Post-partum haemorrhage (B.M.A., est. 1)	1
Manual removal of placenta (both, est. 3)	3
One associated with placenta praevia not separately listed	
Placenta praevia (B.M.A., est. only 1)	1
Total	15

TABLE No. IV. A.—*Percentage Operative Morbidity*
B.M.A. Estimation

Forceps	9·68 per cent.
Manual Removals	15·79 per cent.
Placenta Praevia	20·00 per cent.

TABLE No. V.—*Lacerated Perineums, showing Morbidity*

B.M.A. Estimation alone	16
Rotunda Estimation alone	2
Both Estimations	18
Total	36

Eight of these associated with forceps.

The following Tables are based on those cases morbid by the B.M.A. Estimation :—

TABLE No. VI.—*Duration of Stay in House of Morbid Cases*

Under 10 days	46, including 3 deaths.
10–19 days	39, including 1 death.
20–29 days	7
30–40 days	1
40 and over	1
Total	93

TABLE No. VII.—*Duration of Temperature*

Under 5 days	69, including 1 death.
5–9 days	16, including 1 death.
10–19 days	5
20–29 days	1
Total	91

Two patients died without having had fever.

TABLE No. VIII.—*Highest Temperature Recorded*

100°	100·9°	31
101°	101·9°	21
102°	102·9°	19, including 1 death.
103°	103·9°	11
104° and over		9, including 1 death.
	Total	91

Two patients died without having had fever.

TABLE No. IX.—*Treatment of Morbid Cases*

No treatment	31
Vaginal douche only	2
Uterine douche	48
Quinine only	4
Local treatment	8
Total	93

Of these 93 morbid cases 32 had incomplete membranes, and 17 had retention of lochia due to anteflexion of the uterus.

TABLE No. X.—*Uterine Douches*

	24 patients had 1 douche.
	13 patients had 2 douches.
	6 patients had 3 douches.
	3 patients had 4 douches.
	1 patient had 5 douches.
	1 patient had 9 douches.
Total .	48

For report of Uterine Cultures, *see* Pathological Report.

APPENDIX II

THE CHARTS AT PRESENT IN USE AT THE ROTUNDA HOSPITAL

We have been asked to supply information so often with regard to the special charts in use at the Rotunda that they are published here. Simplicity is the aim in all of them.

1. Ordinary Daily Chart (see Fig. 283).
2. Special Chart (see Fig. 282).
3. Infants' Chart (see Fig. 284).
4. Urgency form for extern department (see Fig. 285.)
5. Chart for private cases (see Fig. 286).

1. **The ordinary chart.** This is used and all details are filled up for every patient in the hospital. From it the "Master's Book" is "written up," whence the Report for the year is compiled.

2. **The special chart.** The notes of every patient suffering from toxaemia, *e.g.* vomiting or eclampsia, or from any illness associated either with pregnancy, labour, or the puerperium, are made on this chart. A special nurse is required as a rule.

3. **Infants' chart.** This is the type in use in the Infants' Ward at the Rotunda.

4. **Urgency form.** Every student is given instructions to fill in every detail of this form when he requires the assistance of the extern maternity assistant on district work.

5. **The author's chart for private cases.**

ROTUNDA HOSPITAL.

Report of Nurses on Special Duty.

Name of Patient.	Admitted.	Age.	Disease.	Operation.	Result.	Discharged.

Date.	Time.		Temp.	Pulse.	Resp.	Sleep.		Vomit	Urine.	Bowels.	Fits.	Amount of Nourishment taken.	Treatment.	General Remarks.
	a.m.	p.m.				hrs.	min.							

Fig. 282.—Chart for special cases.

YEAR 19.....

MONTH.....

ROTUNDA HOSPITAL.

WARD No.....

BED No.....

Name..... Address.....

Age..... No. of Pregnancy..... Period of Pregnancy.....

Admitted.....at.....A.M.....P.M. Assist. Master.....Sister.....

Re-admitted.....at.....A.M.....P.M. Assist. Master.....Sister.....

HISTORY.

Previous Labours: Abortions.....Premature.....Full Term.....Nature.....

Notes from Ante-Natal Department.....

Date of Last Labour.....19.....Last Menstruation ended.....

Health during Pregnancy.....Condition on Admission.....

Previous Illnesses or Operations.....

Temperature on Admission.....Pulse on Admission.....Bath on Admission.....

Measurements: Inter-Spinous.....Inter-Crist.....Ext. Conj.....
- Inlet—Int. Conj.....Trans.....
- Outlet—Int. Conj.....Trans.....

DIAGNOSIS.

	Day	Month	Hour	Signature
Abdominal Palpation and Fœtal Heart Rate				
Vaginal Examination				

LABOUR.

Labour began.....of.....at.....Membranes ruptured.....

Infant Born.....at.....Placenta delivered in.....minutes.

Presentation.....Position.....Nature of Labour.....

Membranes.....

Vaginal Examination before Admission.....

Assistant Master on Duty.....

Sister on Duty.....

Student.....

Nurse in Charge.....Time of Suturing.....of.....at.....

Placenta:
- Variety.....
- Complete.....
- Mechanism.....

Perinaeum:
- Nature of Sutures.....
- No. of Sutures.....

Puerperium.

Date of first leaving bed.....

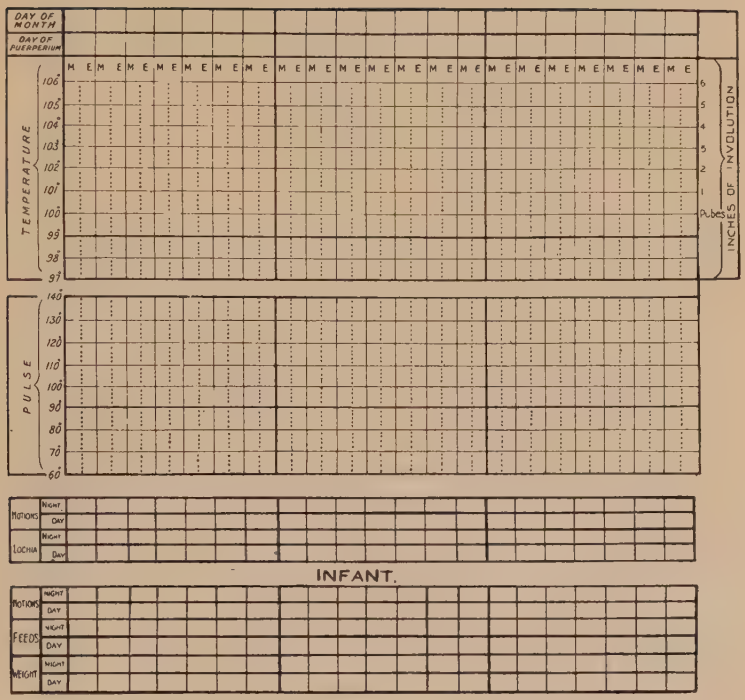
Date of Discharge.....19..... Condition when leaving Hospital.....

Day Nurse in charge.....Night Nurse in charge.....

URINE	
Date	Analysis

NOTES OF THE CASE:—

FIG. 283.—The ordinary daily chart used at the Rotunda Hospital.



Sex..... Length..... Condition at Birth.....

Bathed by Nurse..... Baptized by..... Mode of Feeding.....

On Discharge:—(1) General condition..... (2) Condition of Cord.....

NOTES (*cont.*):—

FIG. 283.—The ordinary daily chart used at the Rotunda Hospital.

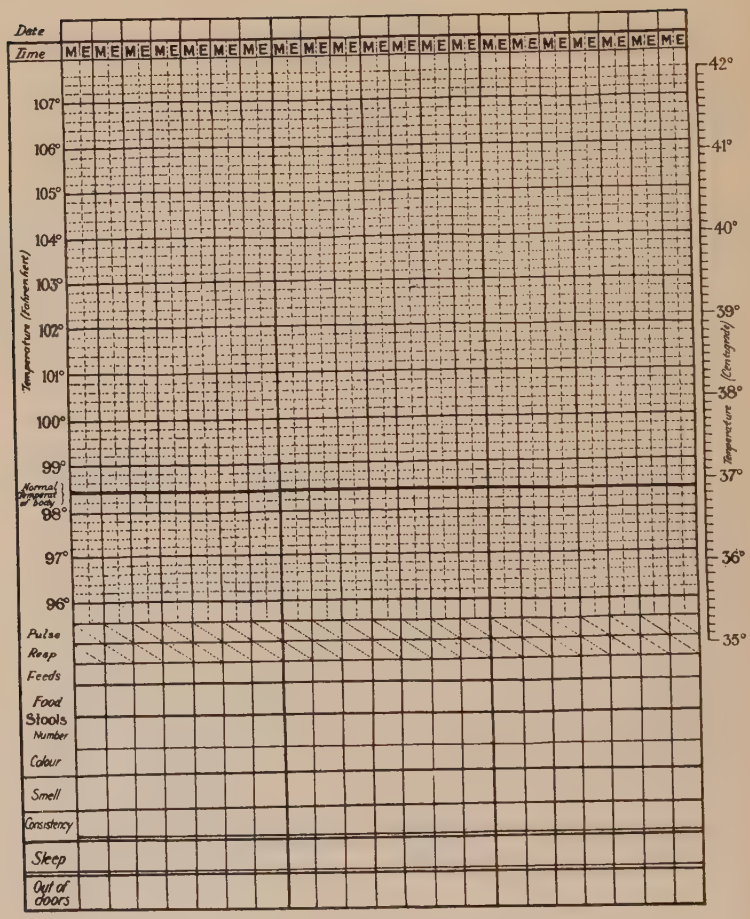


FIG. 284.—The infants' chart.

Telephones: Dublin, 1266 & 1267.

Founded 1745. Incorporated by Royal Charter 1756

ROTUNDA HOSPITAL, DUBLIN.

Scheme for Midwifery Cases Requiring Special Care.

[When a Student requires assistance in a Case, he will fill this up and send it.]

Date Hour

Name of Patient Age

Address

Number of Labour — Character of former labours: Easy; Haemorrhage (before, during, or after); Instrumental; Fits

Period of Pregnancy: Premature / Full Time

Time, commencement of Pains

Time, Show noticed

Time, Waters discharged Foetal heart rate

Presentation

Position

Size of os

Pains, character of ... ... Frequency

Strength

Pulse Temperature Is Pulse rate increasing?

Time of Birth of Child

Condition of Child

Time of Birth of Placenta ... ... Spontaneous or Artificial

Are Membranes and Placenta Complete?

Placenta Retained Membranes Retained

Haemorrhage

Why sent for

Signed

Fig. 285—Urgency form for students in extern cases.

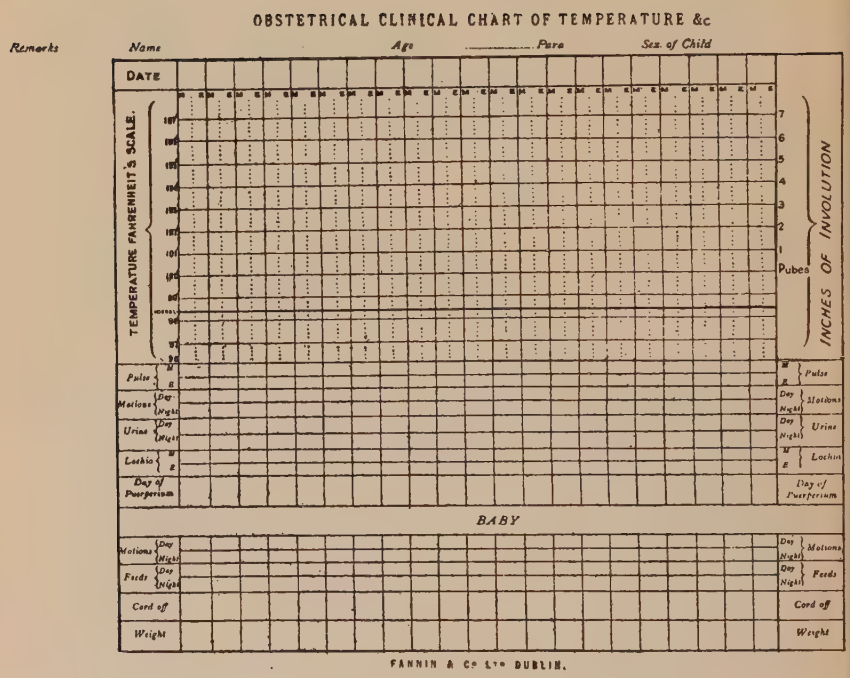


FIG. 286.—Solomons' temperature chart for private cases.

APPENDIX III

PREGNANCY TESTS

We do not give the technique of the Abderhalden reaction nor the Pregl and De Crini's test, since, owing to the cost of apparatus and the difficulty of performing them, they may be considered for our purpose as impracticable, although in theory the soundest. The simpler tests are as follows :

The "Maturin" test. The kidney in pregnancy is more liable to allow filtration of sugar on account of the fact that in this condition the renal epithelium becomes influenced by foetal toxins; consequently we may frequently find in some pregnant women a normal blood sugar content with sugar present in the urine; this is sometimes termed "Renal Diabetes." We can produce artificially such permeability of the kidney by means of various drugs, which act by stimulating the epithelium of Bowman's capsule. The principal substance used for this purpose is phloridzin; it is sold for this test under many trade names, *e.g.* "Maturin" Schering or "Verogravin" Heisler. The amount necessary to produce glycosuria in pregnancy is much less than would be required to produce the same condition in a normal or non-pregnant woman.

The test is performed in the following manner :—A fasting specimen of urine is examined, and if found sugar free, the patient is given an intramuscular injection of 1 to 2 milligrammes of phloridzin. Care must be taken not to inject this substance into the subcutaneous tissues, as it is very painful. At about the same time the woman is given a similar amount to drink. The urine is examined and tested at half-hourly intervals for a period of two hours. If the test be positive, the first and second specimen should contain sugar, while the third and fourth may be doubtful.

In one hundred positive results with this test, eighty-five

were definitely pregnant. In the fifteen cases giving a positive result although not pregnant, these were subsequently found to be cases of latent diabetes or ovarian cyst, etc. In a similar number giving negative results, about two were proved to be pregnant, so that a negative result is of more value than a positive in this test. It has been stated that this may give a positive result three weeks after conception, but it is best not performed until about five weeks after. There are many objections to it; for example, the pain of the injection. The test must not be made in the premenstrual phase whether pregnancy exist or not.

The Glucose test. The patient is given a carbohydrate-free diet for twenty-four hours. The following morning the urine is tested for sugar, and if negative, she is given her ordinary diet, but with the addition of 10 grammes of saccharose. The urine is examined at half-hourly intervals for sugar, over a period of two hours. If positive, all the specimens will contain sugar. This loading the organism with sugar in pregnancy induces the condition known as Renal Diabetes. It is a much easier test to perform, and as reliable as the foregoing.

The Acetone test. This is another modification of the last test, which is founded on an interesting physiological fact. Normally, if we starve a man from carbohydrates for three days, acetonuria will occur. In pregnancy, a comparatively much shorter period of starvation will produce this condition. The test is carried out as follows :—The patient is put on an ordinary diet for one or two days. The morning specimen of urine is examined and tested for acetone. If this be negative, a carbohydrate-free diet is prescribed, *e.g.* tea with saccharin, eggs, bacon or ham, roast or boiled meat. Specimens of urine are taken and tested for acetone at one, three, five, and seven o'clock. If the test is positive, we expect to find acetone present in the first specimen, but certainly in the second. The third and fourth may be doubtful. This test is as accurate and nearly as delicate as the sugar test, and its advantages are obvious.

Sedimentation rate. This is used more to determine the presence of infection than as a test of pregnancy.

There are now a considerable variety of methods of performing this. The method we adopt at the Rotunda Hospital is as follows:—We use a small test tube 6·5 cm. high, and 3 to 4 mm. in diameter, with a mark indicating the level of 1 c.c. of fluid. Below this, marks are made, indicating 6, 12, and 18 mm. respectively. To make an estimation, we take a 1 c.c. syringe and draw up 0·2 c.c. of a 5 per cent. solution of sodium citrate. The vein is then entered, and blood is drawn up to the 1 c.c. mark. The citrated blood is mixed in the syringe by drawing in a bubble of air and reversing several times. The blood is now transferred to the special tube up to the 1 c.c. mark; the sedementation time is noted; the red cells sediment in a normal individual to the 18 mm. mark in 250 to 300 minutes. In pregnancy as well as in many other conditions, the sedimentation time is considerably increased, but as a test for pregnancy this test cannot be used unless the normal sedimentation rate for the individual in question is known: also, the rapidity increases as the pregnancy advances, until at the end of pregnancy the cells may reach the 18 mm. mark in thirty minutes. Therefore it cannot be used to diagnose early pregnancy.

Normal sedimentation rates. New-born baby settles ½ to 1 mm. in one hour. Normal man settles 3 to 5 mm. in one hour. Normal woman settles 4 to 10 mm. in one hour.

Tests for the determination of toxaemia. As already stated in the chapter on Toxaemia, these tests are not diagnostic, but they assist in the diagnosis of some of the difficult types of toxaemia.

Kidney function tests. According to Berkeley, Dodds and Walker, the estimations of the blood urea and the urea concentrating power of the kidneys form the safest means of determining whether a pregnancy should be terminated. A blood urea of 100 mgms. per cent. or over indicates a serious amount of renal damage, and may be considered, when taken in conjunction with clinical findings, to be an indication for induction of labour; *the clinical findings are the important feature.* According to them, if the urea concentration test of MacLean shows a concentration below 2 per cent., induction should be done. *The estimation of the*

blood urea, while useful, is not an indication alone for induction, and all biochemical tests must be taken in conjunction with clinical data.

Tests of hepatic function. The tests which are useful are those which demonstrate changes in the pigmentary functions of the liver. Hepatic changes themselves cannot be shown by metabolic changes.

In order to understand the practical obstetric point in these changes, it must be explained that bile pigments are converted in the intestine into a number of substances, the most important of which are urobilin and its precursor urobilinogen. These two are absorbed into the circulation and are picked out of the liver cells and excreted into the bile as bile pigments, biliverdin and bilirubin. Damage to the liver prevents them from converting urobilin into bile pigments, therefore this accumulates in the liver and is excreted into the urine in demonstrable amounts. The tests when positive show faulty metabolism, and may be regarded as diagnostic of toxaemia. The tests which are most popular, and which we use at the Rotunda, are those of Fouchet and Ehrlich, and are as described as follows.

The student must understand clearly that these tests may be of service, but must not be relied on altogether, as they are sometimes fallacious.

Fouchet. To three drops of serum on a white porcelain surface, three drops of the reagent (20 c.c. H_2O, 2 c.c. of 10 per cent. $FeCl_3$, 5 grms. of trichloroacetic acid) are used. A white coagulum results from the precipitate of the serum proteins by the trichloroacetic acid contained in the reagent. If reaction is present the coagulum turns a greenish-blue colour, reaching a maximum in about twenty minutes.

Tests for Urobilin and Urobilinogen.

Erhlich. To five c.cm. of urine two drops of a 3 per cent. solution of para-dimethylaminoazobenzaldehyde in 50 per cent. HCl are added. If the test be positive, the resulting mixture becomes deep red. Occasionally it is necessary to warm the solution to bring about the reaction. When positive a series of dilutions is made as follows:—1 in 2, 1 in 4, 1 in 8, 1 in 16, 1 in 32, etc. Equal amounts of the

reagent are added to each tube. When a positive reaction results in the "1 in 16" or the "1 in 32" dilution, the urobilinogen is present in pathological amount. Other tests for bile pigments such as Gmelin's, Hay's and the Iodine test may be used.

The sterilisation of glucose. As it is necessary sometimes to give glucose intravenously, the method of sterilisation is given here. When administered by the mouth or by the rectum, the ordinary commercial glucose may be used.

Method of preparation and sterilisation of glucose solution. The solution is prepared from the purest medicinal glucose; that of McFarlane of Edinburgh has given very great satisfaction. The glucose is mixed and dissolved, preferably in distilled water, in sufficient quantity to form a 20 per cent. solution. This is then diluted as required, and a measured quantity, which has been double filtered through blotting-paper filters, is put into a hardened glass flask and the level marked on the glass. A suitable flask is that of the Ehrlenmeyer type, and one pint of the required, solution can be sterilised at the same time. The solution in the flask is brought rapidly to boiling point and kept *gently* boiling for twenty minutes; it is then allowed to cool, being corked with sterile cotton-wool, and the deficiency of solution is made up to the original level marked on the flask by distilled water, which has been sterilised by a similar process. The solution can be kept indefinitely if not uncorked, and after sterilisation should show no marked change in colour. In order to raise the solution to the required temperature (104°) for intravenous use, it may be reheated and kept standing in a vessel of warm water until the operation is performed.

APPENDIX IV

X-RAYS IN OBSTETRICS

The Use of X-rays in Obstetrics

Although X-ray photographs showing the foetus *in utero* have been produced from time to time during the past twenty years, it is only in the last few years that this

Fig. 287.—Early pregnancy.

aid to diagnosis has become practicable as a routine in obstetrics.

The foetal skeleton contains only a small amount of lime salts, and therefore offers little obstruction to the X-rays,

with the result that it throws a poor shadow. In addition to this, the presence of the gravid uterus and liquor amnii, by scattering the rays, renders the shadow still less distinct.

With the earlier apparatus the exposure was of necessity often prolonged, and further blurring was produced by

Fig. 288.—Multiple pregnancy (twins).

respiratory or involuntary movements on the part of the mother, and occasionally by foetal movements.

For many years the X-ray apparatus has been capable of producing much larger currents than the tubes of the period could carry for more than a couple of seconds, and it was not until the advent of the Coolidge tube that heavy currents could be utilised and exposures very much shortened.

This type of tube possesses the further advantage that it is very easily regulated, so that exposures may be made from day to day under exactly similar conditions of current and voltage.

The Potter-Bucky diaphragm became available shortly

Fig. 289.—Multiple pregnancy (triplets).

after the Coolidge tube, and this instrument, which by means of suitably arranged lead strips kept in motion during the exposure cuts off from the film the secondary or scattered rays produced by the soft tissues, and renders possible the production of radiograms showing fine details which had hitherto been unattainable.

Apart from the production of pneumo-peritoneum and the injection of lipiodol and allied substances into the uterus,

it is now possible to detect the presence of an embryo in the uterus as early as the tenth or eleventh week, when the physical signs of pregnancy may leave the diagnosis in doubt. The vertebral column is the most definite part of the shadow

Fig. 290.—Death of the foetus showing overlapping of skull bones.

(see Fig. 287). The absence of any shadow after this period may be taken as evidence that the cause of uterine enlargement is not due to the presence of a living foetus. The age of the foetus can be estimated from the radiographic image, and diagnosis assisted when the size of the uterus

does not correspond to the period of pregnancy, *e.g.* apparent excessive size of the uterus when due to hydramnios.

Multiple pregnancy (see Figs. 288, 289) is clearly demonstrated by X-ray examination, and the relative positions are shown. With regard to the position of the foetus in the uterus, more especially in the case of multiple pregnancy,

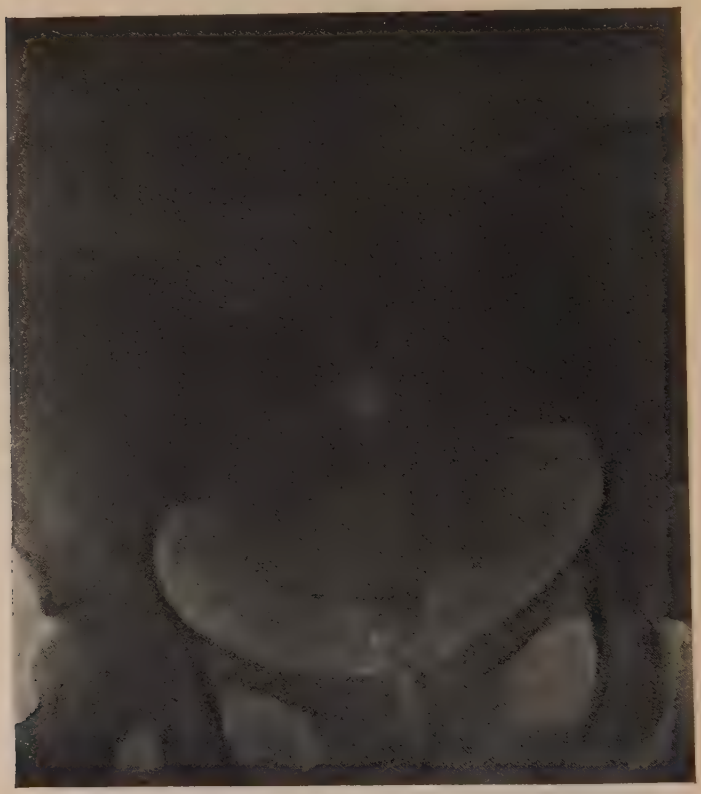


Fig. 291.—Death of the foetus, showing overlapping of skull bones.

it must be borne in mind that great variation in position occurs up to, and probably in the case of twins during labour. We have seen changes in the position when films have been taken within two minutes of each other without movement on the part of the mother.

Death of the foetus (see Figs. 290, 291) is followed by collapse of the skull, and the resulting deformity may on

occasions become evident as early as the fourth day after death: this is illustrated by marked overlapping of the skull bones.

Fig. 292.—Breech presentation.

Malpositions such as Breech (see Fig. 292) can be clearly seen in an X-ray film,

The position of the foetal parts can be clearly demonstrated, and abnormalities such as prolapse of a hand corrected before fixation of the head.

Malformation of the foetus, anencephalus, hydrocephalus,

double monster or other conditions affecting the skeleton may be detected several months before term, and the pregnancy terminated if desirable.

Deformities of the maternal pelvis due to rickets, injuries, bony tumour or other cause may be visualised accurately by means of stereoscopic radiograms, while measurements

Fig. 293.—Vertical view through inlet obtained by position described on p. 444, from which the measurements of the true conjugate, transverse diameter and certain of the head measurements (depending on its position) may be obtained by direct comparison with the scale (cms.).

of the pelvic diameters and of the foetal skull may be obtained, as described elsewhere, with a minimum amount of discomfort to the patient, and the elimination of internal manipulations. It is hoped that X-ray measurements will soon become a routine in all doubtful cases which come under observation at a period when the relative proportions of the head and the pelvic canal are such as to allow an unobstructed delivery. By this means a certain proportion

of cases would be saved the necessity of Caesarean section by selecting a time for induction when the foetus, though possessing a good expectation of survival, would still be capable of being born without undue difficulty.

Fig. 294.—Lateral view of pelvis from which the true conjugate may be measured and also head measurements and information with regard to the outlet obtained.

While it is very desirable that a more extended use of X-rays should be made in obstetric practice, it is hoped that the student may not thereby be encouraged to neglect the physical examination on which he must depend so much during his after career, when the means of making a radiographic investigation will often be out of reach.

Fallacies which may be encountered in X-ray examination in obstetrics.

(1) When the foetus is under four months and has been dead for a considerable time, no shadow may be thrown, because of the decalcification which has occurred. We have demonstrated this to our satisfaction by examination of a foetus which threw no shadow *in utero :* when examined after birth this fact was confirmed.

(2) An anencephalic foetus may easily be mistaken for a breech, unless the whole of the foetus shadow is well defined.

(3) When the woman is at or near full term, unless a sufficiently large film is used, the presence of twins may not be detected.

(4) The promontory of the sacrum may simulate a portion of a foetal skull.

(5) The absence of foetal shadow at fourteen weeks does not exclude pregnancy.

Figs. 293 and 294 are the views of the pelvis required for X-ray pelvimetry, and must be compared with the diagrams included in the chapter on this subject (see p. 444).

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